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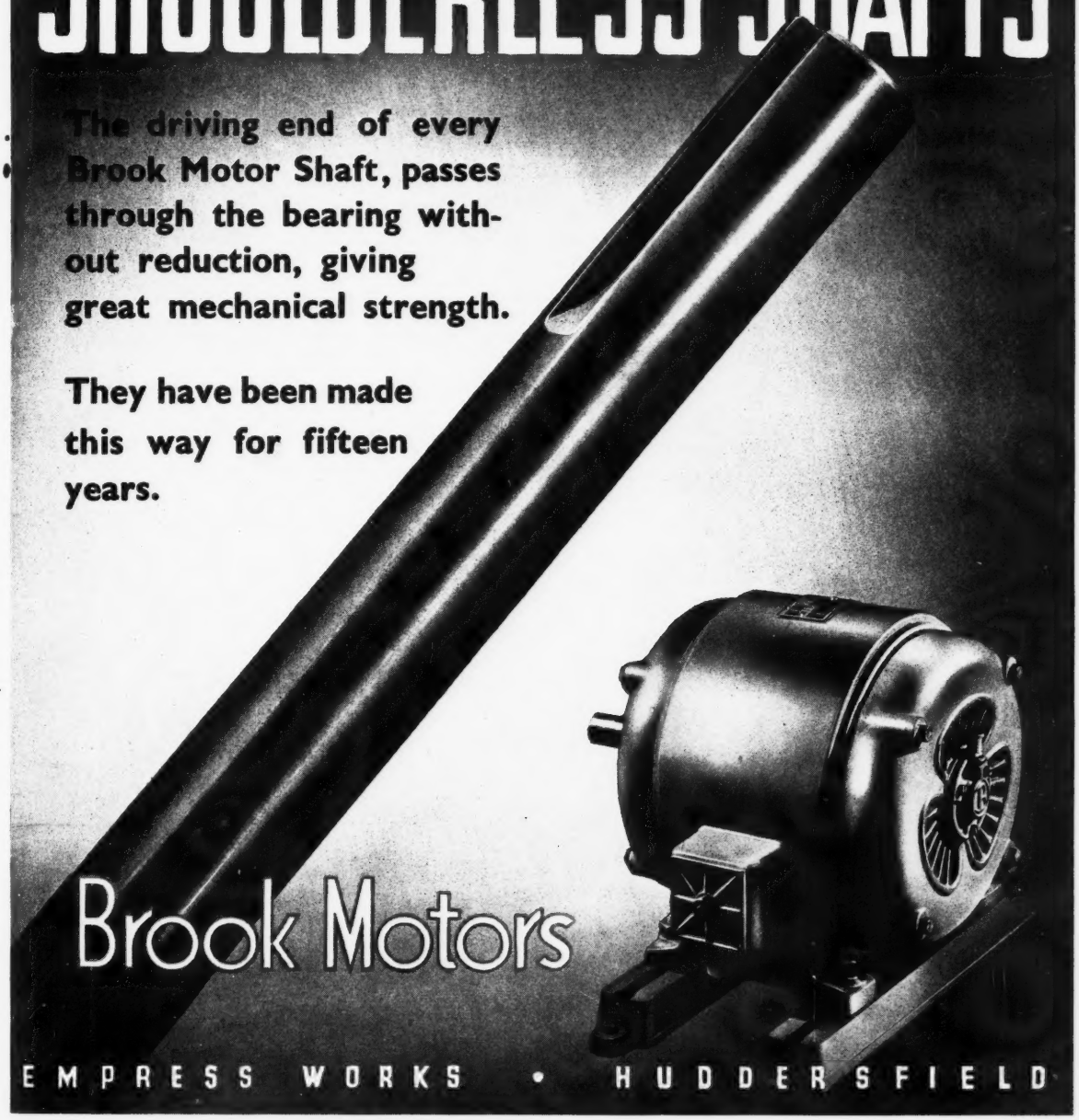

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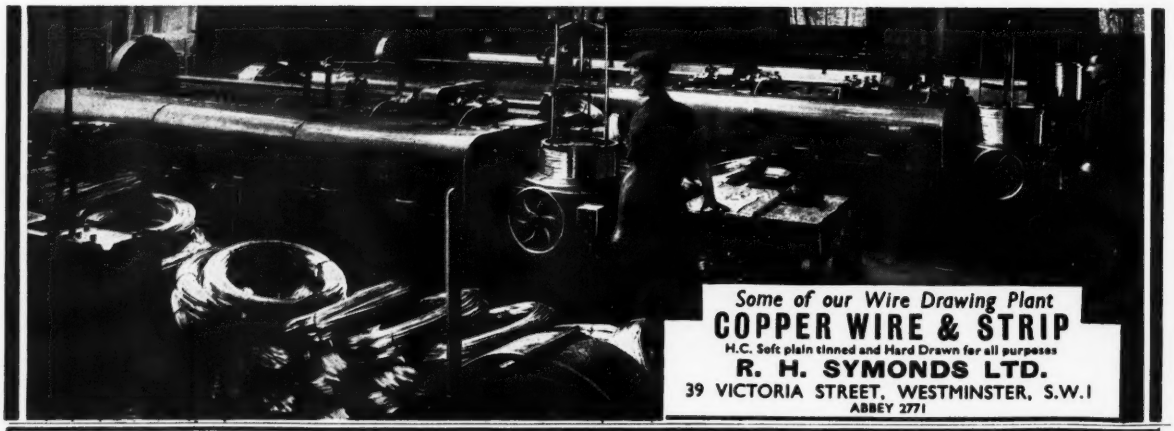
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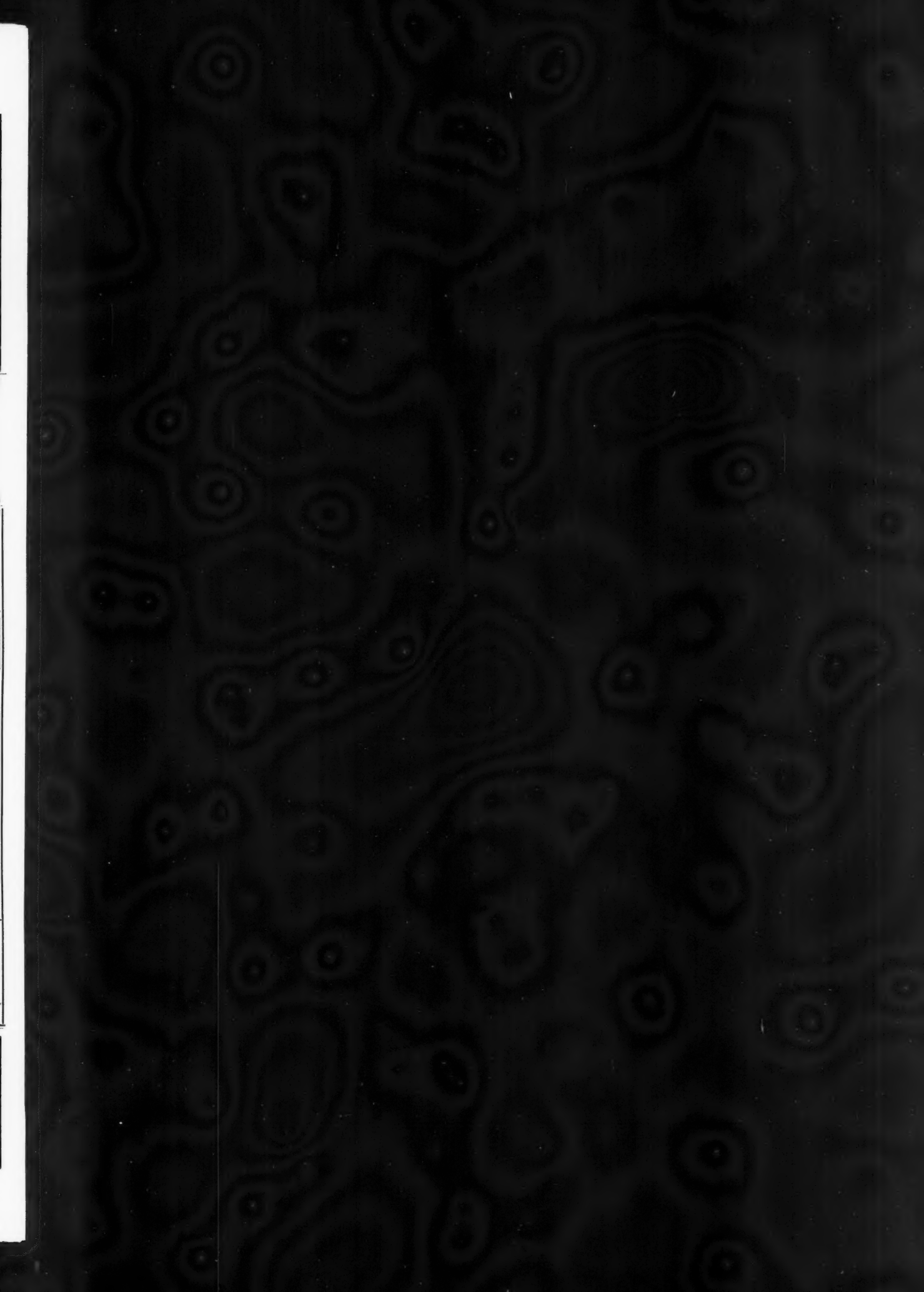

THE
ELECTRICAL REVIEW

Volume CXXVIII — No. 3322

Friday, July 25, 1941

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Safe Installation Work

Home and Dominion Regulations

IN its essentials a code of rules governing the wiring of buildings should aim at preventing risks by shock and fire, at laying down the principles of sound and enduring work and at providing a quality basis for competitive tendering. A set of Standard Regulations for the Wiring of Premises has recently been adopted by the South African Institute of Electrical Engineers which, although professing only to state " requirements for securing safety from fire and shock," does actually go further and, like the I.E.E. Regulations, which are explicit on this point, enumerate the main precautions for " ensuring satisfactory results " generally.

In their broader aspects the two documents are similar and the South African incorporates, with due acknowledgment, a number of paragraphs from the I.E.E. Regulations. There are, however, divergencies in detail, many of which are traceable to local circumstances, in which climate, established methods and existing administrative procedure are factors.

One of the most notable features of the South African Regulations is the extent to which authority is vested in the supply authority's engineer, who appears to be the final arbiter in questions of interpretation and in deciding when certain of the requirements (*e.g.*, the use of earth-leakage protection) ought to be enforced. The word " approved " occurs frequently and is defined to mean " approved by the engineer " of the undertaking.

Uniform Interpretation Desirable

While there is much to be said for giving definite responsibility of this kind to one person possessing a high status in the profession and able to obtain full particulars on the spot, experience in Great Britain indicates the desirability of reserving the right to appeal to a higher tribunal, *e.g.*, the Electricity Commissioners. Some of the Regulations are not easily interpreted and engineers of adjacent undertakings may hold conflicting views on any one issue. Yet it is obvious that decisions made in one case ought to hold good everywhere, especially in England, where there are many areas of supply, one abutting on another. This is particularly important to contractors whose operations may, in this country, cover several neighbouring towns.

A contrast to British views on voltages suitable for domestic applications is implied in the South African rule requiring that, where the system of supply is three-phase, cookers loaded at 3.5 kW or more shall be balanced across phases. This may be compared with the Commissioners' Supply Regulations which prohibit the connection of a three-phase supply to an installation unless its total loading exceeds 8 kW. Of the many smaller variations, attention may be drawn to the condition that in South Africa the minimum capacity of socket outlets is 5 A. Would any tears be shed if the 2-A size were dropped in Great Britain also?

We mention these instances, not to draw attention to the differences in practice in the two countries, which will repay careful study by those concerned in installation matters: our object is to indicate the extent to which other considerations enter into the picture. In this case voltage is evidently regarded from the point of view of steadiness rather than of safety, and other sections from either code could be shown to be designed primarily in order to give a satisfactory supply on good engineering lines.

Proving Houses Needed

Both sets of Regulations, by citing appropriate Standard Specifications, endeavour to ensure that the materials and the methods of construction employed will be such as to provide a good starting ground, but the position here would be strengthened by the setting up of proving houses for the rejection of unsuitable apparatus. Nevertheless, the Regulations represent merely a criterion of what electrical engineers believe to be desirable; they can be worked to or not at the whim of those entrusted with installation work. There is no protection for the public against the most elementary risks that may come from ignoring their provisions.

This raises the question of the feasibility of making compliance with the Regulations obligatory. The safeguards against industrial risks that are afforded by law to factory operatives would provide a precedent, were it not for the inclusion of requirements (highly meritorious in themselves) that cannot readily be proved to bear a close relation to the promotion of safety. That is to say, the Regulations as they stand would probably have little chance of being given statutory force. It would not, however, be difficult to abstract from them for compulsory application something that was manifestly a safety code. The adoption of the full Regulations

would still be regarded as the hall mark of the best practice.

It is one thing to lay down the correct lines for carrying out the work, and quite another to get them followed. Complementary to the introduction of a compulsory code is the need to ensure that its provisions are not flouted. We publish in this issue an account of the way in which this end has been achieved in New Zealand through the registration of all engaged on installation work. By the infliction of penalties, including loss of licence in bad cases of non-observance of the conditions, the enormous electricity consuming public would be safeguarded from the results of ignorance, incompetence or unscrupulous conduct on the part of a few individuals who should be denied the privilege of being members of our industry.

An Engineer Administrator

LORD REITH, in the course of last week's debate in the House of Lords on post-war planning, said that although he might be a newcomer to politics, as an engineer he could judge foundations when he saw them, particularly when he had had a hand in laying them and could see whether they were according to plan and specification, able to bear the superstructure of our ideals. He was replying to criticisms of the Government's proposals for meeting the recommendations of the Uthwatt Committee's report on the subject, but the interest of this particular statement lies, not in Lord Reith's defence of the Government, but in his insistence on the fact that he is an engineer. For many years we have heard arguments in favour of the participation of engineers in political and social affairs. It is, therefore, a considerable advance to have an engineer in the Government. More than that, Lord Reith is an *electrical* engineer and is in a position in which his knowledge and experience is being usefully employed.

The E.C.A. Meeting

IT is a remarkable tribute to the ability and popularity of Mr. Walter Riggs that he should have been re-elected President of the Electrical Contractors' Association for a third successive term. His ability was revealed in the masterly review of the situation in the electrical contracting world which he gave at the annual meeting last week. As we have followed the Association's affairs very closely during the past year there is little more that we can say at present except to comment upon the remarkable way in which the Association has maintained its corporate strength in spite of inevitable casualties among its membership. This has been due largely to the activities of the President and his lieutenants and, no less, to the extremely arduous and varied work of the Director and his staff, who have given the members full value for their subscriptions.

Railway Oil Engines

IN a paper presented to the Diesel Engine Users' Association, Mr. B. Reed expresses the view that although heavy-oil engines of the more conventional vertical type operating through electric transmission have reached an advanced stage of development, the ultimate goal is the direct drive of the track wheels. Progress in mechanical transmission systems has, he considers, been towards giving the oil engine the characteristics of the steam locomotive. This is to envisage the oil-electric system as a temporary expedient due to the present inability of the internal-combustion engine to develop a sufficient torque at low speeds and of mechanical gearing to stand up to the punishment of traction service. While the history of the petrol-electric system for road transport appears to support this opinion, there is still much to be said for the use of an almost constant-high-speed engine of relatively light weight conveniently disposed, which is made possible with electric transmission. The ultimate solution, however, where traffic density justifies expenditure on overhead equipment, is more likely to be the straight electric system with current from an outside source.

Direct Current Testing

THERE is not much to choose between AC and DC when the ruthless breakdown system of testing is applied to high-voltage apparatus. DC has other advantages, however, which are referred to by Mr. J. S. Forrest in this issue. With the DC method, current measurements may indicate the presence of somewhat more general, but still localised, deterioration (which power-factor tests fail to reveal) while any progressive deterioration that might occur during test makes itself evident immediately. In the case of AC, deterioration continues at an accelerated pace as the test voltage is increased, but actual breakdown may be delayed until after the apparatus has been put back into service. On the other hand with AC the stress distribution is the same on test as under working conditions. The conclusion drawn in a recent E.R.A. Report (L/T102), which deals with these points comprehensively, is that the most satisfactory high-voltage test is by means of DC of short enough duration for the stress distribution to be the same as for AC.

Cable Protection

WHILE events have shown recently (and may do so again) that cables have stood up to bombs and blast in a way that could not have reasonably been expected of them, experience in the areas involved points to the need for ascertaining promptly that protective gear is functioning properly. Although power cables may continue to carry current without undue distress, even when bent fantastically, there is always the possibility that their associated pilots may not be intact. As a result of rough usage the main cables may fail, possibly sooner rather than later, so that no time should be lost in testing the pilots for continuity. In this connection suitably graded back-up protection has proved its value. Another point is that the amount of spare cable required for emergencies is usually more than was originally estimated.

A Mica Substitute ?

BENTONITE, a colloidal clay possessing the quality (when mixed with water) of being thick when still and as thin as water when stirred, has hitherto been best known as a suspending agent in paints. It has now been made into sheet form which, it is suggested in *Plastics*, may replace mica. This development is due to the researches of Dr. E. A. Hauser and Miss le Beau at the Massachusetts Institute of Technology. In a communication to that journal Dr. Hauser states that, while there are unlimited deposits of bentonite in the United States, other abundant kinds can be converted into the type needed for the production of these self-supporting films. His aims are at present to find a satisfactory substitute for natural mica and other electrical insulation that is resistant to chemical action.

Air Conditioning

THE growing realisation of the importance of complete air conditioning as opposed to mere heating and ventilation is shown by the decision of the Institution of Heating and Ventilating Engineers to add the words " air conditioning and drying " to the description of the Institution's objects wherever they are stated in the articles of association. The alteration was approved in the High Court last week. Air conditioning is a field in which there is tremendous scope for electricity, and in the post-war reconstruction no new public building should be considered fit for use unless a conditioning system is installed.

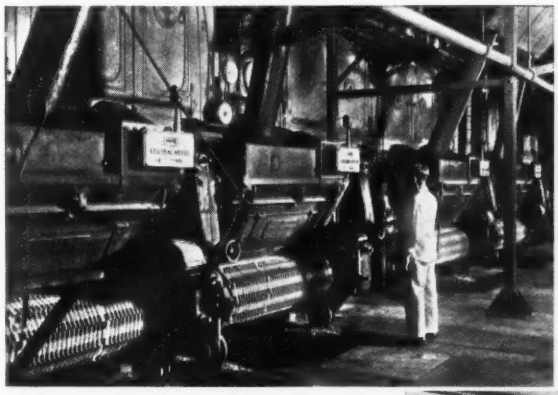
Boiler Economy—3

Need for Accurate and Adequate Measurements

In this concluding article of the series various types of measuring apparatus for securing maximum efficiency and low operating costs are described

NOT one of the systems, equipments and devices referred to in the two previous articles in this series* as contributors to the economic operation of boiler plant can be applied with the maximum possible efficiency without complete information of its functioning at any one time, and such information can only be obtained by accurate measurement, involving the use of one or more suitable instruments in every case. We use the term " maximum possible efficiency " in the idealistic sense and somewhat guardedly, for will the battle ever be won between the two schools of thought representing " all out " efficiency on the one hand and a sort of compromise on the other hand? One thing is certain, however, that wherever higher efficiency is aimed at, more instruments and instruments of greater accuracy are employed.

The last word in efforts to attain higher thermal efficiency from the purely operational viewpoint is probably the fully automatic boiler installation; yet what confidence could a combustion engineer have in the operation of such a system without the ready means of measurement at any one time? We have certainly yet to see the fully automatic boiler house without a greater complement of instruments than the manually-operated high-efficiency boiler house. But it is undeniable that the operator in the latter boiler house is dependent on functional information for every move he makes; thus, the instrument seems to have a pull either way, and we are always tempted to say, " Why not? " when we consider the very small costs of instruments in relation to the cost of the major plant.



The problem of coal measurement, like the equipment, is very simple . . .

Coal and Water

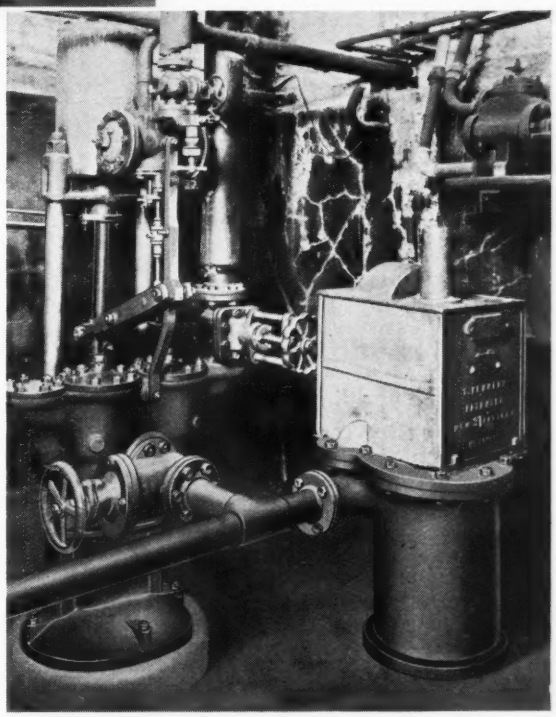
Without any attempt, indeed competency, to indicate what is the most important class of boiler-plant instrument, we can confidently start off with coal measurement as a primary necessity, for what is more fundamentally important than the determination of " lb. of water per lb. of coal "? We do not propose to deal with the normal weighing of coal, which must take place at the colliery and at the power station to permit of ordinary commercial transactions, nor shall we enter into the difficulties pertaining to moisture content, with which are bound up the problems of sampling. The point of focus is boiler operation, for which it is desirable to know the rate of feed of coal. This can be ascertained by normal weighing operations which are usually rather of an intermittent character and, in any case, not peculiar to the boiler house.

The alternative is coal measuring, the acceptance of the principle of which depends upon an appreciation of the principles of equal volume—equal weight. We believe that, like ourselves, most engineers have had to witness the test before they would believe that equal volumes of coal of different sizes weigh the same, despite proof by calculation.

Once it is accepted, however, the problem of coal measurement, like the equipment, is very simple. An example is the Lea coal meter, which measures the rate of flow of the coal as it passes under the fire door of a chain-grate stoker on the principle of the quantity per given time equalling the product of the width of the grate, the thickness of the fire and the velocity of the grate, all in suitable units. The velocity of the grate is transmitted to a spirally-toothed drum with a pitch proportional to the maximum lift of the fire door. A toothed counting wheel geared with the spiral drum and a counting box is mounted upon a draw-bar directly connected with the fire door, and as this door is opened or closed the counting wheel is moved to and fro across the spiral drum, which revolves it according to its lateral position.

With the fire door fully- or half-opened, or shut, the counting wheel will engage with all, half or none of the drum teeth, while if the speed of the grate is doubled so will be the speed of the counting wheel. The revolutions made by the counting wheel, then, are proportional to both the fire thickness and the grate speed, so that the recording of the quantity required is only a matter of selecting suitable constants for counting dials.

By the factor " lb. of water per lb. of coal " we must treat feed water measuring as equally important. The weight and volume difficulties disappear in this case, and the flow principle of measure-

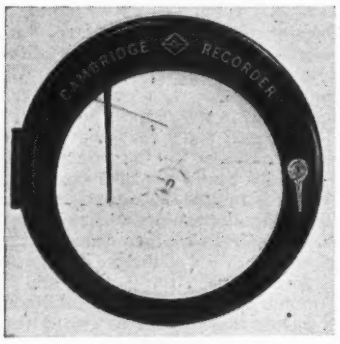


The measuring cylinder forms the base of the hot-water meter and is fitted with a metallic piston . . .

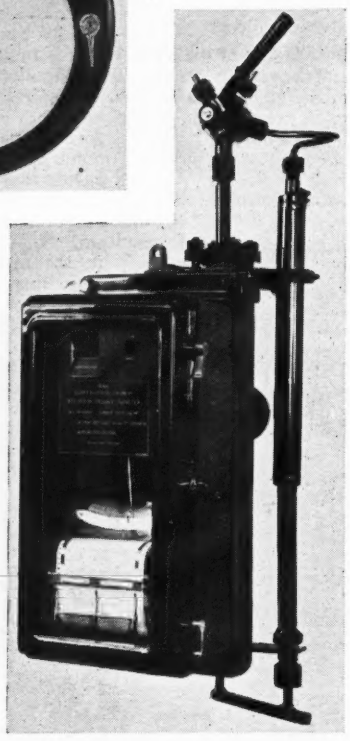
* ELECTRICAL REVIEW, July 11th, p. 805, and July 18th, p. 825.

ment is unquestioned. A difficulty that does arise, however, relates to the controversial point of measurement after (under pressure) or before (without pressure) the feed pump.

In the Kennedy hot-water meter for boiler feed work the measuring cylinder forms the base of the meter and is fitted with a metallic piston which is attached to a rack, which gears with a pinion on the shaft. The shaft is turned in reverse directions, actuating the indexing and reversing gear as the piston moves up and down. A main bevel wheel on the main shaft transmits the right and left rotating motion to two bevel wheels on the bevel shaft by means of a ratchet wheel and catches. Each bevel wheel slips during the motion in one direction, but drives the bevel shaft during motion in the other direction, so that the bevel shaft always rotates in the same direction, as does the worm wheel attached to it, which then transmits the motion to the leading index wheel. The index, therefore, moves as long as the piston is moving, and whether the stroke be long or short the exact displacement is always recorded. The water to be measured is directed by a cock key to the bottom of the cylinder and forces the piston up. The water which on the previous down stroke entered above the piston is forced through a passage in the cylinder cover and directed by the cock key into the outlet passage.

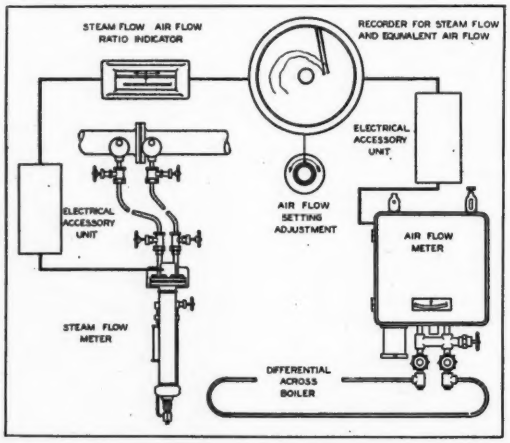


Steam pressure in the main should be continuously recorded



The float-type steam flow meter works on the mercury manometer principle

In the Lea feed-water recorder use is made of the old and well-tried V-notch principle, the water simply flowing under gravity through a V-notch in a weir in the measuring tank. The flow through the V-notch is automatically controlled in accordance with the demands of the feed pump by means of a double-beat equilibrium valve actuated by lever and float in the hotwell end of the tank. The float rises and falls with the level of the water, and an upward float rod carries a pointer, which moves against an indicating scale. It also carries a rack which gears with a pinion on the axis of a spiral drum, the curve on which is cut and calibrated according to the formula for the discharge over the V-notch in use. A pin working in the groove actuates a pen and causes it to move in direct proportion to the rate of flow.


STEAM FLOW AIR FLOW RATIO INDICATOR
RECORDER FOR STEAM FLOW AND EQUIVALENT AIR FLOW
ELECTRICAL ACCESSORY UNIT
AIR FLOW SETTING ADJUSTMENT
AIR FLOW METER
ELECTRICAL ACCESSORY UNIT
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DIFFERENTIAL ACROSS BOILER

The rate of air flow to the furnace may be compared directly with the rate of steam flow by the steam flow/air flow ratio meter

Steam Measurement

The obvious importance of maintaining constant steam pressure is such that the pressure in the main for the boiler should be continuously indicated and recorded. The Elliott steam pressure transmitter for remote indication consists of a Bourdon pressure gauge fitted with a transmitter by means of which readings are conveyed to distant receivers. A number of receivers can be operated from one transmitter, and they usually consist of an illuminated dial indicator in the boiler house and a smaller unit in the control room. Only two pilot wires are required between the transmitter and the receiver and there are no contacts or relays.

In the Simmance (Wright) low-pressure gauge variations in pressure are transmitted by a diaphragm through a vertical plunger attached to a horizontal spindle by means of a tension link and a lever adjustable in effective length and counter-weighted to maintain tension on the lever system, thus eliminating possibilities of backlash. The spindle carrying the pointer and adjustable lever is supported in cup bearings on a bracket and converts the reciprocating motion of the diaphragm and tension link to angular motion. This is imparted to the pointer, which moves over the quadrant scale.

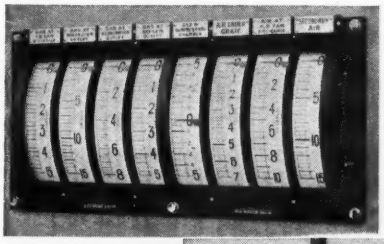
For low ranges the movements of Electroflo indicating and recording pressure gauges are of the metallic bellows type, and for high ranges of the multi-turn helical pattern, so as to attain high sensitivity and precision with easily read scales.

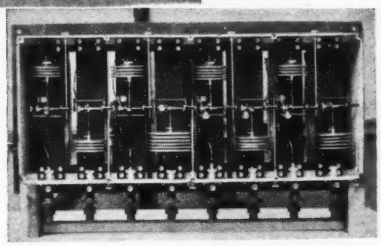
It is on the utility side perhaps that the steam flow meter reflects its greatest influence on economical operation. At a large factory the boiler plant was apparently insufficient, but the steam meters indicated the maximum demands and showed where alterations of operational times could be made to level out the daily demand curve. These and similar steam adjustments were made which ultimately led to one boiler out of five being dispensed with, thereby saving about 1,800 tons of coal per annum. The Elliott float-type steam flow meter works on the mercury manometer principle and is suitable for measuring the flow of steam with working pressures up to 1,000 lb. per sq. in.

Reasonable efficiency in working can be obtained by measuring the CO_2 percentage

Because there are still many industrial power houses without CO_2 measuring instruments the following notes are given to stress the economic value of these indispensable aids to efficiency. The heat obtained from burning coal comes mainly from the combustion of the carbon in the fuel with the oxygen in the air to form

carbon dioxide. If the supply of air is insufficient, combustible gases, carbon monoxide and hydrogen will be produced and escape in the flue, with consequent loss of heating energy. If, on the other hand, too much air is used, part of the fuel energy will be wasted in heating the excess. For every boiler there is a certain percentage of excess air at which the sum of the two heat losses is a minimum. With a decrease in excess air the heat loss rises very sharply, and with an increase the heat loss also rises, but comparativelyslowly.





Coupled with efficient combustion is the increasing attention given to draught control; 8-point draught gauge, front and back interior

The maximum efficiency generally occurs when the flue gases contain between 10 and 14 per cent. CO_2, and reasonable efficiency in working can be obtained by measuring CO_2 percentage.

The Cambridge CO_2 instruments employ the thermal conductivity method, which depends on the fact that the heat loss from a hot wire is a function of the thermal conductivity of the surrounding gas. Four identical spirals of platinum wire are enclosed within cells in a metal block and connected with an indicator, so that they form arms of Wheatstone bridge circuit. Two of the cells are filled with air saturated with water vapour and the other two are exposed to the flue gas under test, which is also saturated with water vapour at the same temperature. An electric current is passed through the bridge, causing the spirals to become heated and to lose heat to the walls of the cells. As their temperatures and, consequently, their resistances depend upon the thermal conductivity of the gases surrounding them, changes in the CO_2 content of the flue gases cause deflections in the indicating or recording galvanometer.

Ignition Method

The Elliott $CO + H_2$ meter depends for its operation on the heat generated when CO and H_2 are burnt in air to form CO_2 and H_2O. The gas sample, after passing through the CO_2 meter, is mixed with sufficient air for complete combustion and then flows through a metal tube containing a resistance wire at a temperature of 450 deg. C., at which it acts as a catalyst, enabling the CO and H_2 to ignite at temperatures below their normal flash points. This reaction causes heat to be liberated, so that the wire is still further heated and the consequent rise in resistance is a measure of the unburnt gases in the sample.

The Electroflo CO_2 recorder is of rugged all-metal construction and is driven by a ½-HP totally enclosed AC or DC motor. All the mechanism is continuously oil submerged. The Elliott combustion heat loss recorder consists of an electrical CO_2 transmitter and pyrometer stems whose readings are combined in a recorder with a special cross coil movement. The instrument has the advantage that an increased significance is given to a comparatively small change in CO_2 and flue gas temperature readings.

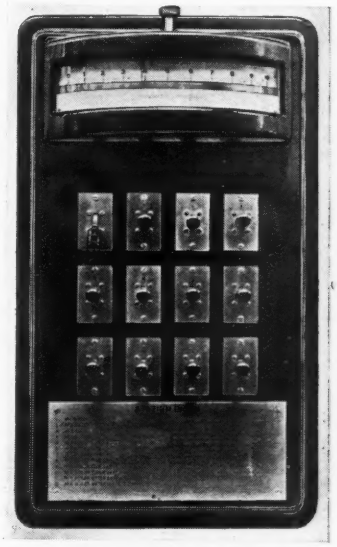
In drawing immediate attention to alterations in the working conditions the combustion engineer is able to detect incorrect firing or faulty operation. The amount of air required for satisfactory combustion is practically the same for all fuels, so the air may be regarded as a fuel and its rate of flow to the furnace compared directly with the rate of steam flow, the correct relationship of air and steam for the given conditions being determined by the CO_2 measurement. In the Electroflo steam flow/air flow ratio indicator one element is part of the steam flow meter circuit and the other part of the air flow meter circuit. When the air flow is excessive or insufficient the difference in current value causes the indicating pointer to move left or right, thus indicating that the air supply should be increased or decreased.

Coupled with efficient combustion is the increasing attention given to draught control. In the Alexander Wright draught gauge multi-fold metallic diaphragms are employed, and transmission is through link and lever to the pointer, with gravity controls.

Temperature Measurement

Included in the increasing number of indispensable measurements consequent on the search for greater efficiency and lower operating costs are such temperature values as saturated steam, superheated steam, feed water and flue gas at economiser inlets and outlets, air preheater outlet, hot air to grates, fuel beds and combustion chambers. The temperatures range from about 80 deg. F., and the following are the types and ranges of Foster temperature measuring instruments: Expansion thermometer (mercury in steel), 0 to 800 deg. F.; electrical resistance thermometer, −400 to +1,100 deg. F.; thermo-couple pyrometers, 0 to 2,000 deg. F.; radiation pyrometers, 1,500 to 3,500 deg. F.

In the expansion thermometer a Bourdon tube is expanded under the increase of pressure as the temperature of the mercury in the bulb rises. The resistance thermometer depends for its functioning upon the change in the electrical resistance of a calibrated coil of fine wire with changes of its temperature. The employment of an external source of excitation and means of regulating this excitation inevitably make the electrical resistance thermometer more complicated than the thermo-couple pyrometer, but owing to the Wheatstone bridge system the temperature scale does not have to commence at zero and may be made to cover any particular range up to the maximum. The thermo-couple pyrometer functions by virtue of the fact that an EMF is developed when two dissimilar metals are joined together in a common junction which is heated.



The development of multi-point indicators is a logical consequence of the necessity to take values at many points

Owing to the minuteness of the EMF at the lower temperatures the balance is in favour of the resistance thermometer at the lower end of the range. The radiation pyrometer is used exclusively for fuel bed and combustion chamber measurements. The receiving tube contains a very small thermo-couple with a hot junction embedded in a heat-receiving plate mounted at the point of focus of a lens or mirror.

The multi-point indicator is a logical development born of the necessity to take the values at many points, and the Foster multi-point indicators are almost without exception of the edgewise type, which offers a longer scale and freedom from balance errors in the moving-coil system. A Cambridge recorder can be arranged to give one, two, three or four records in different colours on a chart 5 in. wide, or six or eight records on two charts side by side. Similarly, multiple metering is essential in co-ordinating boiler measurements and the records on an Electroflo roll chart instrument may be boiler feed, water flow, steam flow, CO_2 percentage, steam pressure and temperature.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE General Electric Co., Ltd., announces the appointment of **Dr. A. H. Railing** and **Mr. Leslie Gamage** as general managers of the company. Dr. Railing has been particularly concerned, as a director, with the engineering and manufacturing sides of the G.E.C., while Mr. Gamage is secretary and director in charge of the company's overseas business.

At a recent investiture at Buckingham Palace, **Captain T. Lockett,** manager of the Stoke-on-Trent Electricity Department and Deputy A.R.P. Controller for the City of Stoke-on-Trent was invested by the King, with the O.B.E. which was awarded to him in the Birthday Honours List. Captain Lockett was appointed manager of the Stoke-on-Trent undertaking on the retirement of the late Mr. C. H. Yeaman, to whom he was commercial assistant for fifteen years.

During his annual leave in 1938 Captain Lockett attended the Home Office Anti-Gas School and, qualifying as an instructor, played an active part in A.R.P. work. At the outbreak of the war he was appointed Deputy A.R.P. Controller.

Mr. C. A. Britton, M.Eng., M.I.E.E., A.M.Inst.C.E., deputy electrical engineer and manager to the Chester City Electricity Department, has been appointed borough electrical engineer of Maidenhead.

Greenock Corporation on July 15th appointed **Mr. W. A. Woodrow,** burgh electrical engineer at a commencing salary of £800. He succeeds Mr. D. McDougall, who was killed while on duty during an air raid. Mr. Woodrow has been employed at the works for about thirty years and was latterly assistant to Mr. McDougall. A discussion took place at the Town Council meeting on Tuesday on the recommendation to appoint Mr. Woodrow. A member asked that the recommendation be taken back by the Committee, as he wanted to see the appointment open to anyone who wished to apply. He also referred to the question of salary, and pointed out that the Association scale for the appointment was higher than that agreed on by the Committee. He saw no reason why the scale should not be paid.

Another member felt that Mr. Woodrow was filling the late Mr. McDougall's position satisfactorily and he did not see why there should be any reduction in the Association's scale. He agreed, however, that the post should be open to competition. Supporters of the Committee's recommendation stated that several Corporation officials were paid below the salary scales asked by the Association and that they could not allow the Association to state what salaries should be paid. The recommendation to appoint Mr. Woodrow was then adopted by 13 votes to 10.

Mr. O. Lucas has been elected a director of Electric and Musical Industries, Ltd. Mr. Lucas is deputy-chairman and joint managing director of Joseph Lucas, Ltd., and a director of C.A.V., Ltd., and Rotex, Ltd.

Mr. Geoffrey Cunliffe has joined the Industrial and Export Council as a business member, at the invitation of the President of the Board of Trade. In consequence he relinquishes his post as Aluminium Controller to the Ministry of Aircraft Production, but will be available for consultation.

I.E.E. Scholarships.—The following scholarships have been awarded by the Institution of Electrical Engineers for 1941 :—Duddell Scholarship (annual value £150; tenable for three years): To Mr. J. C. Cain (Emanuel School, London). Silvanus Thompson Scholarship (annual value £100, plus tuition fees; tenable for two years): To Mr. R. C. Langford (H.M. Dockyard, Portsmouth). William Beedie Esson Scholarship (annual value £120; tenable for two years; renewable in approved cases for a third year): To Mr. E. Bailey (Metropolitan-Vickers Electrical Co., Ltd., Manchester). David Hughes Scholarship (value £100; tenable for one year): To Mr. W. Davies (University College, Cardiff). Salomons Scholarship (value £100; tenable for one year): To Mr. C. G. Cheshire (Heriot-Watt College, Edinburgh). Paul Scholarship (annual value £50; tenable for two years): To Mr. R. Pocock (L.C.C. School of Engineering and Navigation, London). Thorrowgood Scholarship (annual value £25; tenable for two years): To Mr. R. G. Bates (London, Midland & Scottish Railway Co.).

As was the case last year, no awards of the Ferranti or Swan Memorial Scholarships or of grants from the War Thanksgiving Education and Research Fund have been made this year.

Mr. A. H. Harvey, of Blackburn, has been appointed managing director of Inniss & Riddle, engineers and contractors, of Shanghai and Hongkong. Mr. Harvey served his engineering apprenticeship with Yates & Thom, engineers, at Canal Foundry, Blackburn, and he joined Inniss & Riddle in 1931, after being employed on power plant construction work in China and South America by the British Thomson-Houston Co., Ltd. In 1936 he became director and sales manager.

Mr. K. Helliwell, of Bradford, has been appointed senior mains assistant with the Lincoln Corporation Electricity Department.

Mr. C. T. Portwine, acting power station superintendent to Darlington Corporation has been appointed permanently to the position.

The Canadian *Electrical News and Engineering* reports that **Mr. Alex. Lloyd,** senior sales engineer to Bepco (Canada), Ltd., has just completed twenty-five years' service with that company and its constituents, and has been presented with an engraved wrist watch to commemorate the event. Mr. Lloyd was born in Liverpool and was with British Insulated Cables, Ltd., before going to Canada in 1912 to join the staff of the Lancashire Dynamo & Motor Co. of Canada, Ltd.

Major (temp. Lieut.-Col.) R. A. Bagnold, M.A., A.M.I.E.E., has been awarded the O.B.E. for distinguished services in the Middle East.

Towards the end of last year the North East Coast Institution of Engineers and Shipbuilders completed a membership affiliation agreement with the Society of Naval Architects and Marine Engineers, U.S.A. Among the members of the Society who have recently connected themselves with the North East Coast Institution under this agreement is **Mr. David W. Niven,** manager, Federal and Marine Department of the General Electric Co. of America.

Obituary

Mr. E. Kilburn Scott, M.I.E.E., A.M.Inst.C.E., consulting engineer, whose death on July 12th was briefly announced in our last issue, was educated at Leeds Middle Class School and Yorkshire College (now Leeds University). He joined the Brush Electrical Engineering Co., Ltd., as assistant dynamo designer and later became chief assistant engineer with Johnson & Phillips, Ltd. He was subsequently chief inspecting engineer to Robert Hammond, after which he became manager in the United Kingdom and Colonies for the International Electrical Engineering Co., Liége.

Mr. Scott then proceeded to Australia, where for four years he was in charge of electrical engineering at the University of Sydney, and on returning to this country became lecturer at the Northampton Polytechnic, London. For four years Mr. Scott was in New York as a consulting engineer. Setting up a consulting practice in this country, he carried out a number of important engineering schemes covering power station plants, mining electrical installations and electro-chemical research. He was a lecturer, consultant and patentee on the subject of atmospheric nitrates and developed a 3-phase furnace for their production. During the last war he was with the Ministry of Munitions. Mr. Scott was an honorary member of the Association of Mining Electrical Engineers.

Mr. H. W. Hilliar, C.B.E., whose death occurred on July 15th, at Eltham, was formerly a superintending examiner in the Patent Office. He was particularly concerned with automatic telephones of which he had a comprehensive knowledge.

American Developments

SHARP increases are reported in domestic sales of electric refrigerators in the United States during March, and for the first quarter of 1941 in a report issued by the National Electrical Manufacturers' Association. According to the *Electrical World* reports to the Association from twelve companies indicate that 393,425 units were sold during March, as compared with 277,379 units for the corresponding month last year. During the quarter ended March 31st sales totalled 1,076,661 units, as compared with 756,957 units for the first quarter of 1940.

Canadian sales in March amounted to 5,840 units, as compared with 6,397 units in March, 1940, and for the first quarter of the year were 14,458 units, as against 14,944 for the corresponding period of 1940. Total world sales amounted to 412,099 units in March, as compared with 291,999 for March, 1940, and 1,122,994 for the first quarter (against 795,187 for January–March, 1940).

Electric cooker sales in continental United States, Alaska and Hawaii totalled 61,647 units in March, as compared with 39,643 units in March, 1940, and for the first three months were 163,953 units (against 109,036).

The Vacuum Cleaner Manufacturers' Association reports that March sales of vacuum cleaners showed an increase over March, 1940, of nearly 26 per cent., the total for the month being 224,329 units (against 178,68 1units).

Hire-Purchase Proposals

A big movement is on foot in America to cut down the period of hire-purchase transactions from a maximum of three years to two years. The *Evening Standard* reports that Montgomery Ward and Sears Roebuck, two of the leading mail-order firms in the country, are the first companies to announce a change in their business methods. New orders on the hire-purchase plan cannot now be carried out unless a more substantial initial payment than previously is made or the customer agrees to larger monthly payments. With regard to some articles, such as refrigerators, electric stoves, etc., about 33 1-3 per cent. of the purchase price is required as the "down payment."

It is generally realised that the big part now being played by America in the war effort will mean a substantially greater demand for steel and other metals and that there may be a necessity shortly for manufacturers of such articles as refrigerators to reduce production. It is therefore hoped that this voluntary scheme among the bigger companies will find all-round support, for the main reason for the action at the moment is to discourage excessive buying that may develop in expectation of price advances.

Power for Armament Work

Addressing a recent meeting of Washington public utility district commissioners, Dr. Paul Raver, Bonneville administrator, predicted that the demand for power from defence industries on the Columbia River would be about 1,000,000 kW within eighteen months. The Bonneville and Grand Coulee power plants would have 532,400 kW of capacity by December and 640,400 by next June. Bonneville Dam's maximum capacity, 518,400 kW would be reached in 1943. Dr. Raver said that units at Grand Coulee were being expedited. This undertaking has an ultimate capacity of 1,900,000 kW, of which 324,000 kW is now under installation.—*Reuter's Trade Service.*

Insulation Testing

A Portable Instrument for Site Tests on High-voltage Plant

By J. S. Forrest, M.A., B.Sc., F.Inst.P.

A practical compromise between the cumbrous equipment needed for insulation power factor tests and the simple, but limited, insulation resistance set is found in the use of DC at moderate voltages

IT is now generally recognised that in order to minimise supply interruptions due to the breakdown of insulation it is necessary to institute a regular scheme of insulation testing on site. If tests are carried out sufficiently frequently and with suitable equipment, deterioration of insulation may be detected in its early stages, so that the faulty insulator can be replaced before a complete breakdown occurs.

Although it is clear that some form of test should regularly be applied to all types of insulation in service, it is not so easy to decide on the form which such tests should take. A power-factor test probably provides the best all-round measure of the condition of an insulator, but in order to obtain the maximum amount of information from this test measurements must be made over a range of voltages up to at least the normal working voltage of the insulator. For tests on a 132-kV system, a transportable 100-kV testing equipment would be required, and even for lower-voltage systems, the power-factor measuring apparatus is bulky and expensive. In addition, the power-factor test is essentially an overall test and certain types of local failure in the insulator have a negligible effect on the power factor of the insulator as a whole.

In order to detect such forms of deterioration it would be necessary to supplement the power-factor measuring equipment with radio-frequency discharge detectors and with apparatus for the measurement of potential distribution. On the other hand, serious deterioration of high-voltage insulators can often be detected before ultimate breakdown by means of an insulation resistance test at 500 V; in this case the testing equipment is relatively inexpensive and convenient to use, although it would fail to detect certain types of deterioration which would be located by the more comprehensive equipment. Compromise between the two extremes mentioned is necessary and a testing technique must be selected that will locate the majority of types of incipient failure with a maximum of convenience.

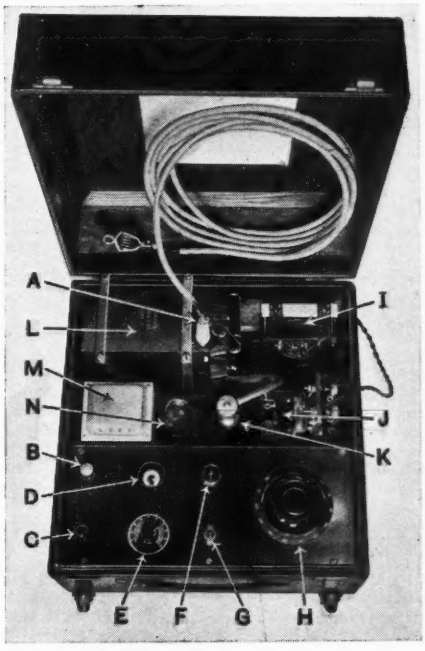


Fig. 3.—Test set showing components
A—High-voltage terminal; B, C—Alternative earth terminals; D—Cathode ray indicator V3; E—Resistance R1; F—Pilot lamp; G—"On-off" switch; H—Voltage regulator; I—High-voltage transformer T1; J—Filament transformer T2; K—High-voltage rectifier V1; L—High-voltage smoothing condensers C4, C5; M—Low-voltage transformer T3; N—Low-voltage rectifier V2

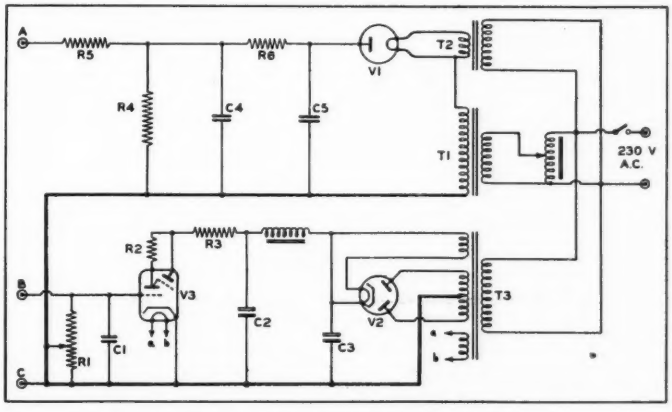


Fig. 1.—Circuit diagram of insulation-testing set

A common compromise is to make power-factor measurements at a relatively low voltage; thus, testing sets having maximum voltages of 5 kV or 10 kV are often used for testing insulators on systems having working voltages up to 220 kV. Such testing sets are reasonably portable, the total weight being 1 to 2 cwt., but equipment of this kind would fail to detect abnormal ionisation in high-voltage insulation at the service voltage. Another possibility is to apply a DC test of moderate voltage, and it is suggested that this is the most satisfactory compromise for general use.

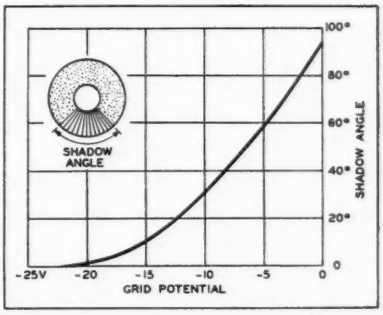


Fig. 2.—Variation of shadow angle with grid voltage of indicator tube

It is a fundamental principle in testing that the stresses applied in the test should be as similar as possible to the stresses to which the test object is subjected in normal service. AC apparatus should therefore, in general, be tested with AC. The main objection to DC testing of AC equipment is that the stress distribution is determined by the leakage resistance when DC is applied, and by the capacitance with AC. The stress distribution with a DC test might therefore differ greatly from that in normal service—so much so, that on some types of insulation it is inadvisable to apply a DC voltage of the same order as the service voltage.

On the other hand, there is no objection to applying a DC test voltage which is considerably less than the working AC voltage, and in practice the DC test has many advantages. The majority of insulation failures in service are due to the presence of moisture, which gives rise to conducting paths on the internal or external surfaces of the insulator. A DC test is a very sensitive detector of deterioration of this type as the leakage current is not masked by capacitance current. The absence of capacitance current is also advantageous, in that apparatus of large capacitance can be tested with a test equipment of small rating.

It was decided that the DC test set should have a maximum working voltage of 5,000, which it was considered would give a satisfactory test on insulators for working voltages of from 11 kV to 132 kV. Provision was made to reduce the output voltage of the set so that tests could also be made on 6.6 kV and lower voltage systems. Another reason for choosing the maximum working voltage of 5,000 was that this is employed in television receivers, so that the necessary components are easily obtainable.

In order to measure the leakage current a cathode-ray tuning indicator ("magic eye") is used. This device is exceedingly sensitive and can easily detect currents of a few

micro-amperes. In addition, it is much more robust and less expensive than a moving coil meter of equivalent sensitivity. The cathode-ray indicator has many applications as a measuring device, and a 400-V insulation test set utilising an indicator of this type has been described by the author (*Wireless World*, July, 1941).

The 5,000-V test set was designed to measure insulation resistances up to 25,000 MΩ at full voltage. The set is operated from a 230-V 50-cycle supply. The high-voltage DC is obtained from the transformer T1 (fig. 1) and the high-voltage rectifier V1 ("Osram" U16 or "Brimar" VLS61), the filament of which is heated by the transformer T2, which must be insulated for 5,000 V. The primary of the high-voltage transformer T1 is supplied through a regulator, enabling the DC output to be varied smoothly from zero to 5,000 V. A 10-MΩ resistance R4 is connected across the output to discharge the smoothing condensers when the set is switched off.

In order to safeguard the rectifying valve if the insulator under test breaks down, a 5-MΩ resistance R5 is connected in series with the high-voltage supply. This resistance limits the high-voltage current to 1 mA, and thus also prevents the operator from receiving a dangerous shock. A separate transformer T3 and rectifying valve V2 are used to supply the cathode-ray indicator tube V3 (Type 6U5).

The insulator under test is connected between terminals A and B, while terminal C is earthed. Alternatively, if, as is usually the case, one side of the insulator to be tested is permanently earthed, the earth connection is removed from terminal C and made to terminal B. In either case the leakage current of the insulator under test flows through the variable resistance R1, thus varying the grid potential of the indicator tube. Changes in the grid potential produce corresponding changes in the shadow angle of the tube (fig. 2). If therefore the resistance R1 is varied until a predetermined shadow angle corresponding to a definite grid potential is obtained, then the setting of the resistance is a measure of the leakage current and consequently of the insulation resistance of the insulator under test.

It has been found convenient to employ two ranges corresponding to shadow angles of 20 deg. and 85 deg., that is, to grid potentials of —12.5 V and —1.0 V. A transparent scale marked with angles of 20 and 85 deg. is fixed over the end of the indicator in order to facilitate the measurement of the shadow angle.

The resistance R1 has a maximum value of 5 MΩ and should have exponental characteristics in order to obtain an open scale. A 0.1-μF condenser C1 is connected across the input to the indicator in order to eliminate any induced AC voltages which may be picked up by the grid circuit and which would result in a poorly defined shadow angle. The dimensions of the complete equipment are 16 by 16 by 11 in., while the weight is only 40 lb.

Method of Use

The testing procedure is straightforward; the equipment to be tested is taken out of service and the high-voltage terminal A of the test set (fig. 3) is connected to the insulator under test. Terminal B or C on the test set should be earthed, as explained above. As one electrode of the insulator under test (*e.g.*, a bushing flange) will usually be permanently earthed, the earth connection is nearly always made to terminal B. Guard rings may be used to exclude surface leakage and should be connected to terminal C.

The set is then switched on and the voltage increased to the desired value, resistance R1 being initially set to zero. Resistance R1 is then increased until the shadow angle decreases to 85 or to 20 deg., depending on the range used, and the setting of R1 is then noted. Suppose, for example, that with a voltage of 5,000 a shadow angle of 20 deg. is obtained with resistance R1 set at 2.5 MΩ. The grid potential is then 12.5 V, so that the leakage current has a value of 12.5/2.5 or 5 μA, which corresponds to an insulation resistance of 1,000 MΩ.

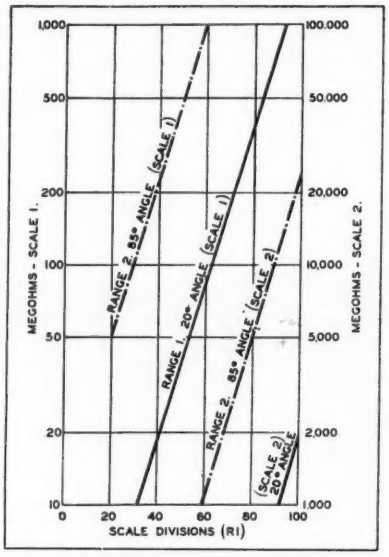


Fig. 4.—Calibration at 5,000 V, using 5-megohm log-law resistance for R1

In practice R1 is provided with a scale which enables its setting to be determined accurately, and the insulation resistance is obtained directly from the setting of R1 by means of a calibration curve (fig. 4). On range 1 (20 deg. shadow angle) insulation resistances of from 10 to 2,000 MΩ can be measured, while on the more sensitive range 2 (85 deg. shadow angle) resistances of from 50 to 25,000 MΩ can be measured. The accuracy is about ± 10 per cent. which is ample for measurements of insulation resistance.

Interpretation of Results

Little difficulty is found in the interpretation of the results obtained; on high-voltage apparatus the insulation resistance of individual insulators should exceed the maximum value which can be measured (25,000 MΩ). If the insulation resistance is some thousands of megohms it is an indication of deterioration, while if the resistance is less than 100 MΩ the insulator is in a dangerous condition.

Unless it is intended to make measurements of the leakage on the external surfaces of the insulators, testing should be carried out in dry conditions, and the relative humidity of the atmosphere should not exceed 70 per cent. Under damp weather conditions the resistance of the external surface of a high-voltage outdoor bushing insulator, for example, may easily be less than 100 MΩ, and might lead to wrong conclusions being drawn as to the condition of the insulator dielectric.

A few values of insulation resistance obtained with faulty insulators may be quoted :—Six 33-kV outdoor switchgear bushings were found to have insulation resistances varying from 20 to 300 MΩ. These bushings were all taken out of service before ultimate breakdown occurred, and when the bushings were dismantled it was apparent that failure in service would have taken place soon. Deterioration was caused by the ingress of moisture due to faulty gaskets. An 11-kV orifice insulator was found to have an insulation resistance of only 0.6 MΩ. This insulator was associated with a similar one which had failed in service.

Faulty porcelain overhead-line insulators also usually have low insulation resistance, and in a number of cases examined the resistances of the faulty units were found to lie between 0.02 and 100 MΩ. The test set may therefore be employed to check the condition of line insulators which live line tests have shown to be probably faulty. It can also be used for the measurement of the insulation resistances of transformer and alternator windings, among other applications.

Fire Prevention in Wartime

Home Office Adviser's Hints

MANY points covered in a lecture recently delivered to the Royal Society of Arts by Lt.-Col. G. Symonds (Fire Adviser to the Home Office) were of general electrical interest. After having emphasised the need for adequate fire fighting parties for taking immediate action and having dealt with questions of organisation, the lecturer referred to the "protective levels" required for resisting penetration by a 1-kg incendiary bomb as follows:—2½ in. reinforced concrete; ⅜ in. steel plate; ¼-in. plate with 1 in. of breeze concrete; 2-in. paving stone; well-tamped standard sand-bag. In some cases these suggested thicknesses of protective materials were less than the figures proposed in some documents.

Internal protection levels provided conditions under which the bomb could burn out harmlessly. After clearing out combustible matter, floors and constructional work should be made fire-resisting. This could be done with 2 in. of sand, 2½ in. of brick rubble passing ⅜ in. mesh, 2½ in. of weak concrete mixture or with material conforming to BSS/ARP 27. Less certain protection, but enough to enable a fire party arriving within five or six minutes to cope with the bomb before floor boards started to burn, would be provided by BSS/ARP 47. Structural timber must be treated with material in accordance with BSS/ARP 39. A list of such flame-resisting materials might be issued shortly by the Ministry of Home Security.

Communicated fire could be stopped, he said, by 2½-in. jets supplied with 1,200 gallons of water a minute. Where an 80-ft. space was unobtainable as a fire break, the windows facing a lesser gap should be bricked up or, failing this, provided with wired-glass and fire-resisting shutters. An unperforated 14-in. brick party wall with good mortar carried 10 ft. above roof level on the line of the break would often be found to stand up well to a "near miss."

Photometric Devices

Different Methods of Employing Light Cells

There are three main ways of measuring light and characteristic instruments employing these principles are described

IN photometry pure and simple there are three general methods of procedure. First, a photo-cell may be exposed to a standard light source and then to the unknown source ; if linear in output, the two cell currents compared will give the desired figure. Secondly, two cells may be connected in opposition and balanced ; on illuminating one with a known source and the other with the unknown, the known source may be controlled in intensity by suitable means until the balance is regained. The third method avoids any question of linearity or change in light response of the cell; the standard and unknown light sources are made to act on the cell alternately, the standard being controlled until no flicker is observed. In all such photometers the photo-cell may indicate a figure of relative brightness quite different from that of the eye, due to the difference in its spectral response, though the use of light filters can largely set the matter right. Even this is not necessary with a cell of the " Eel " type, fig. 1, (Evans Electroselenium, Ltd.), for its spectral sensitivity is very similar to that of normal vision.

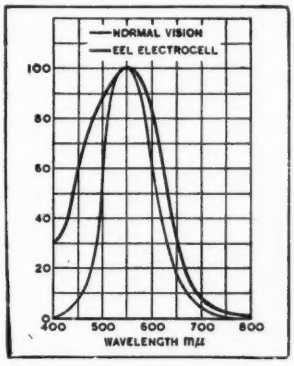


Fig. 1.—Spectral sensitivity of " Eel " photo-cell

A direct reading lumen photometer described by Winch and Harper (see fig. 2) took the form of a cubical integrator of 2 ft. 6 in. side having a small aperture about 2 in. square in one side screened from the direct light of the lamp under test. The luminous flux was received through the aperture, into an adjoining small subsidiary integrator which contained the cell. The design was such that the flux in the small integrator was directly proportional to the total lumens of the lamp in the main integrator. A K.M.V. -6 (G.E.C.) cell was used. By combining two cells, one sensitive to red and the other to blue, in a bridge, each cell being mounted in a subsidiary integrator receiving integrated light from the main integrator, the colour temperature of a lamp can be measured by shuttering off one light until the valve bridge amplifier is in balance. The shutter scale is calibrated in degrees Kelvin.

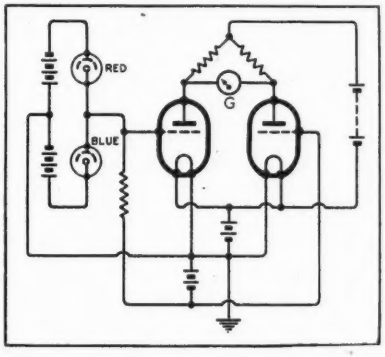


Fig. 2.—Winch & Harper circuit for direct-reading lumen photometer

Flicker photo-cell photometers are described by Ryder, Gier and Boelter in the *Transactions* of the American Illuminating Engineering Society (Dec., 1939). According to Moon and Severance, if due precautions are taken, this type is capable of greater precision than can be obtained with any other photometric method, provided the illumination is not too low.

The very low levels of illumination necessitated by the war involve measurement in small fractions of a foot-candle. The Holophane - Edgcumbe street lighting photometer (fig. 3), in which an Everett-Edgcumbe " Autophotic " cell is used in conjunction with a portable indicator reading direct in ft.-candles, measures 12 in. by 7½ in. by 7 in., and weighs 10 lb. The full-scale deflection on the lowest range may be as low as 0.0125 ft.-candle (12.5 milli-ft.-candles), so that it is possible to obtain reliable readings from 0.0002 ft.-candle upwards. (See ELECTRICAL REVIEW, December 29th, 1939, p. 819). An important feature of the "Autophotic " cell is that it will give a true indication of the illumination at very large angles of incidence, up to 75 deg. The spectral energy curve of the cell closely resembles that of the eye, so that no adjustment is needed for electric, gas, or daylight, except for mercury vapour or sodium.

Fig. 3 (left).—Holophane - Edgcumbe low-level illumination meter

Fig. 4 (right).—Everett Edgcumbe auto-photometer for head lamps

Another meter recently introduced by the same company for use with motor-car headlights is the auto - photometer (fig. 4) (see ELECTRICAL REVIEW, February 7th, 1941, p. 345) reading direct in ft.-candles on a 5¼ in. dial, horizontal, the sensitive surface being vertical so as to receive the light from the headlamp normally to that surface.

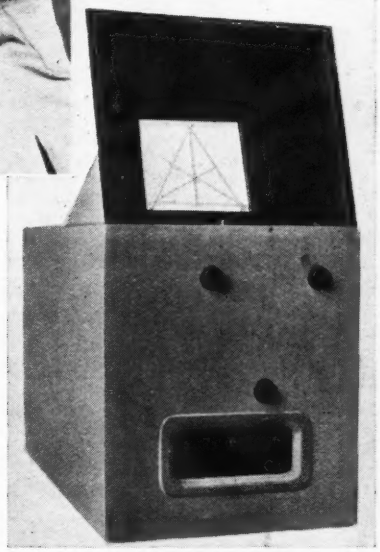


Fig. 5. — Three-galvanometer colorimeter, showing colour triangle (G.E.C.)

One of the most ingenious and daring of metering appliances is, undoubtedly, that of the Eastman Kodak camera, in which the light reflected from the subject to be photographed is used through the medium of a photo-cell to regulate the amount of exposure given by the lens and shutter. The photographer has thus no need to measure the value of the light with his ordinary exposure meter, as the exposure is automatically regulated and controlled by the light intensity of the subject before the camera. The use of barrier layer cells for estimating photographic exposures is universal and has become a source of great economy of material

in motion picture studios apart from the improvement of the standard of amateur and commercial photography.

An elegant solution to the problem of colour measurement is the photo-electric colorimeter referred to by Dr. C. C. Paterson in a recent presidential address to the Institute of Physics (fig. 5). Three selenium rectifier type photo-cells (Salford) with colour filters of the three primary colours (blue, green and red) are connected with three Cambridge d'Arsonval galvanometers, which with an appropriate optical system are made to project line *images* so arranged to fall on a diffusing screen that, with the galvanometers at zero, the lines form an equilateral triangle. The light to be analysed, according to its colour, causes deflections of the galvanometers and corresponding movement of the three lines in directions perpendicular to their length, towards the centre of the triangle. The point of intersection of the lines eventually gives the red, green and blue values of the light source without the necessity for calculation, or R.G.B. coefficients of any convenient system related to the C.I.E. system of colour measurement.

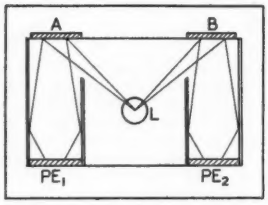


Fig. 6.—Reid colour comparator for textiles

A colour comparator for textiles, made by the Reid Manufacturing Co., Ltd. (fig. 6), utilises two opposed photo-cells mounted in internally silvered tubes PE_1 and PE_2 upon which the light from a single source L is reflected from specimens at A and B, one being a standard and the other the unknown sample. The complete apparatus is neatly built into an oxidised steel case 10 in. by 10 in. by 8 in., readings being made with a Sangamo-Weston centre-zero microammeter. Owing to the fact that most textile materials are seen only in daylight or incandescent light, the very commonsense course has been taken to make the two readings, one with a blue "daylight" bulb and the other with a plain tungsten filament lamp.

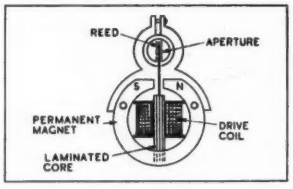


Fig. 7.—Typical light-interrupting reed valve for use above 1,000 c/s

The circular cell with central aperture already referred to in connection with Lange's meter, which has proved so valuable in electrical picture transmission, was due to Dr. Schriever of the Telefunken Co. A very intense beam of light is focused down to a fine point through the centre of the cell, which is placed close to the picture scanning cylinder, from which it is reflected back on to the annular cell. The arrangement is stated to be equivalent to the use of a lens of F/0.5 aperture, an increase of some fifty times the efficiency of the plain bulb type cell. The light from a 75-W lamp acting on a scanning area of about 0.008 by 0.006 in. gives about 0.002 lumen on the cell; with the RCA-868 photocell this will provide 0.1 μA, the cell having a gas amplification factor of not more than 7. The light is interrupted to admit of AC amplification. The light chopper originally used was a slotted disc placed in the light beam and driven by means of a synchronous motor at constant speed. More recently reed valves have been employed to interrupt the light, as illustrated in fig. 7.

Use of circular "doughnut" cells sensitised with different alkali metals to different parts of the spectrum has been made by the writer in the photo-electric resolution of coloured photographs into the "separation negatives" which are required for the purpose of four-colour printing.

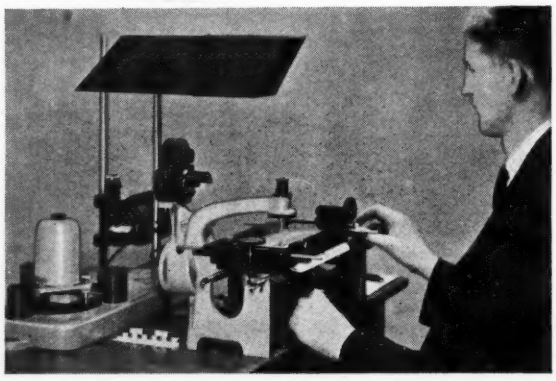


Fig. 8.—Hilger photometer for evaluating spectrograms of metal alloys

Photo-electric cells have a definite field of application in connection with rapid works analysis in the steel and non-ferrous industries by means of the spectrograph. If an arc is struck between electrodes of a metallic specimen such as a steel alloy and examined with the spectroscope, the light is resolved by the prism into a number of coloured lines by which the elements can be identified. If the lines are compared with those of pure iron, the metal alloyed with the iron in the steel sample can be discovered by comparison. In photographic work the ultra-violet spectrum is more conveniently employed, and photographs are taken of the standard and unknown spectra. Measuring the density of certain lines in the negative and comparing them with those of alloys of known composition is a very rapid and highly accurate method of works analysis.

Without describing the laborious methods of comparison of the spectral lines, most of which are excessively fine or narrow, it will suffice to say that photo-electric microphotometers are being used more and more for this work. Some work has been accomplished recently in the direct comparison of the intensities of spectrum lines without the intermediate step of photography, but microphotometers of the non-recording type have been adopted for routine analyses.

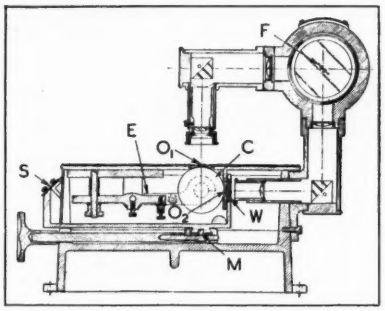


Fig. 9.—Watson density meter for photographic films

The instrument consists essentially of a light source, a carriage to take the spectrum negative, a fine slit and a photo-cell, mirror galvanometer and scale. The light is focused through the slit upon the line to be measured, which is moved by micrometer motion across the slit. The densest (central) part of the line will obscure the maximum amount of light and the cell will give the minimum reading. The log ratios of the intensities are plotted on the spectrum line chart instead of direct ratios, and in this way have been found to differentiate with surprising accuracy between samples of alloys, the spectrograms of which showed no visual difference.

In the most recent Hilger instrument (fig. 8) the lamp is under the horizontal sliding carrier, and after passing through the negative the light is deflected by a 90 deg. prism in the reading head above, on to a Tinsley galvanometer at the back. By a very ingenious optical arrangement a scale is projected by the mirror which moves over a small screen with a fixed index. The observer sees an enlarged image of the moving scale in the rectangular box at eye level, and the necessity for continually transferring his attention to the usual horizontal wide scale of the instrument is consequently avoided.

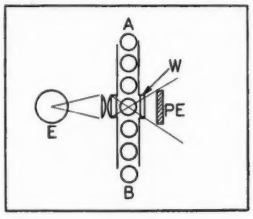


Fig. 10.—Representation of pellets discharged downward from solenoid-operated hopper

The measurement of densities in a photographic negative has become of the highest importance in motion picture processing, astronomy and many branches of engineering research. The sole means of putting photography on a quantitative basis is by the correlation of the amount of light falling upon the sensitive film and the density of the image when developed, the relationship being linear between *log* exposure and density over a considerable range of light intensities. The great improvements that have been effected in the reproduction arts in black and white and especially in colour have been due largely to densitometric studies.

The photo-electric density meter made by W. Watson and Sons, Ltd., which was designed in the laboratories of the British Photographic Research Association (fig. 9), utilises a single photo-cell C, on which two symmetrical beams from a single light source F are directed through opal diffusing glasses O_1 and O_2. The vertical beam passes downwards through the photographic plate whose density is to be measured; the horizontal one passes through a neutral grey glass wedge having regularly decreasing transparency of 0 to about 1/1000th (density = 3). By an ingenious sort of dissolving shutter, as one beam is cut out the other is allowed to come in, and when the two light sources are of equal intensity when one is alternated with the other there will be no movement of the galvanometer recording the photo-cell current on the scale. As

different densities in the photograph are measured, so the neutral grey wedge is racked (M) into the new position to give zero deflection. The density of the wedge at each position is read by the vernier and scale S, so indicating the densities of the various parts of the photographic negative. Recent modifications have been introduced whereby the densities of paper prints can be measured by reflected light.

By combining two or more cells the response to colour of which combines to give that of the human eye, the spectral absorption curve of a dye solution or the reflectance curve of a printing ink or coloured material can be plotted by measuring successive narrow strips of the spectrum. Automatically recording instruments of this kind have been designed which draw a graph of the spectral chart within one minute, readings being made at every 100 Angstroms from 4,000 to 7,000 A.

Recent advances in barrier layer cells makes it look as though this type may largely replace the photo-electric cell proper for both facsimile transmission and photometry. A very small cell, 5 mm. by 1 mm. only in area, has been used with success for sub-standard talking pictures, which, aided by the inclusion of a 2-henry inductance in the load circuit, has given an improved frequency response of about 6,000 cycles. Another type of barrier-layer cell scanner has been introduced recently which operates an airbrush that projects an ink or dye upon the surface of a sheet of paper wrapped round the receiving drum; by suitable gearing the latter can be many times the diameter of the scanning drum, so that greatly enlarged copies can be electrically "sketched" from a small original.

Space forbids the description of the almost indefinite applications that are being followed up with this versatile tool, but one counting device may be described as indicative of the type with the aid of the diagram, fig. 10, representing tablets or pellets being discharged from a solenoid operated hopper through a tube AB provided with a window W opposite a lamp E. Light from the lamp is focused on to the photo-cell PE, current from which operates a mechanical counter through a relay.

Contractors' Annual Meeting

Mr. W. Riggs to Continue as President

AT a meeting of the Council of the Electrical Contractors' Association on July 15th Mr. Walter Riggs was elected president of the Association for the third successive year, thereby establishing a record; he had already served as president in 1924-25.

To celebrate the award of the M.B.E. to Mr. Riggs for his services to the Royal National Lifeboat Institution the Council members collected £27 among themselves; this, with 20 guineas given by Messrs. W. R. and J. Rawlings, has been handed over to the R.N.L.I.

The annual general meeting of the E.C.A., the N.E.C.T.A., Ltd., and the National Federated Electrical Association followed the Council meeting, and after formal preliminaries Mr. Riggs presented his report for the past year. In a reference to enemy air raids, he said that the Association coupled its sympathy with members who had suffered with a desire to be of practical assistance. The goodwill of members towards one another had been a most potent factor in all these difficulties.

He had no hesitation in saying that the most impressive Association experience of all of them since the outbreak of war had been the receipt of special letters from the Director (Mr. L. C. Penwill) covering every phase and aspect of their wartime business difficulties. No sooner was an Act, Order or Regulation published than there arrived a letter giving each member clear guidance as to his responsibilities in the matter. This had necessitated an immense amount of research and investigation.

The Association's main efforts during the past year had been devoted to the object of securing the greatest degree of organisation to ensure that the Association and industry made the fullest contribution to the national effort. But although co-operation seemed to be the key-word of the Government the individual isolationist often appeared to receive support and encouragement to the detriment of those who extended their co-operation for the good of the industry and for the greatest possible service to the community.

Although it had been necessary to reduce the number of meetings with manufacturers their general relationships had been maintained at a higher level than before the war. All sections of the electrical industry seemed to be imbued with a desire to extend the greatest possible assistance and co-operation to meet wartime difficulties.

Labour Problems

The mass of Orders issued by the Ministry of Labour had been very confusing and he could not help feeling that had the Minister of Labour taken into consultation a variety of associations with specialist knowledge of the problems of their own particular industries a good deal of the confusion would have been avoided.

The apparent labour shortage had been one of the biggest problems with which the members of the Association had been faced. Labour had been transferred to work of national importance, sometimes resulting in the closing-down of members' businesses, but there was evidence of a wastage of skilled labour in a variety of directions. Representations had been made to the Minister, and although there was reason to believe that certain steps had been taken by way of adjustment, it was by no means certain that those steps had been sufficiently drastic and efficient. He regretted that the Association's offer of practical help had not been accepted.

Regular meetings with the Electrical Trades Union had been held and serious consideration had been given to the War Adjustment Agreement made between the E.T.U. and the N.F.E.A. in November, 1939. In the early part of the past year the N.F.E.A. sought a review of its terms and there were prolonged negotiations with the object of finding a formula to take the place of Clause 3 of the agreement.* Unfortunately all efforts to secure a mutually acceptable adjustment had failed and the E.T.U. had referred the matter to the National Arbitration Tribunal. He, Mr. Riggs, joined with the then General President of the E.T.U. in regretting that such a step had been taken. It was the first occasion on which the N.J.I.C. had failed to solve its own problems. The Tribunal had not upheld the union's claim that Clause 3 should remain an integral part of the agreement and had referred the matter back to the N.J.I.C. for a further attempt at settlement, with or without an independent chairman.

Certain matters which were under consideration by the N.J.I.C. at the outbreak of war had had to be left in abeyance, but he was anxious to ensure, circumstances permitting, that the organisation of the industry in labour matters should be so pursued that the most favourable relationship should exist between both parties to help in meeting after-war problems.

Mr. Walter Riggs, M.B.E., president of the E.C.A. for the third successive year

There had been a reduction in membership of the Association. He extended the Association's sympathy to those members who had had to close their businesses and expressed the hope that they would be able to return to active membership after the war. Any help which the Association could give would be freely afforded.

The President then referred to the memorandum upon the grouping of members' businesses which had been issued by the Association. He said that it was not in the national interest, let alone in the interest of the individual member, that businesses should be compelled to close through insolvency. Suggestions had been made that the E.C.A. should take effective steps to bring about the amalgamations which were visualised, but although the Association was anxious to be of all possible service, the individual decision of the member in matters of this kind was one that was outside its purview.

The smooth operation of the Purchase Tax was undoubtedly the result of the numerous consultations which had taken place between the Government and various trading interests before its introduction. In a reference to the Prices of Goods Act, the President said that the Association was keeping an eye on developments and no effort was being spared to protect the interests of the membership.

Post-war problems of re-planning and reconstruction were receiving full consideration by the Minister of Works and Buildings, and the Association was keeping in touch with all developments and was examining such proposals as had emerged. To enable the Association to take its proper place in dealing with these and kindred problems full loyalty and support of the membership was imperative.

Mr. Riggs concluded his address with expressions of thanks to Mr. W. H. Walton, chairman of the Executive Committee, Mr. H. J. Cash and other past-presidents, and to Mr. Penwill and his staff. He hoped that the time was not far distant when the members would be able to greet each other in happier and more peaceful circumstances.

Mr. W. H. Walton presented the accounts and balance sheet, which showed the financial position of the associations to be a very healthy one. Mr. Rawlings seconded the adoption of the accounts, which were duly accepted.

* Clause 3 provides for the variation of the cost-of-living addition according to the rise or fall of the Ministry of Labour index figure.

Electrical Legislation in New Zealand

Wiremen's Registration and Electricity Rules

IN view of the repeated demand for the registration of electrical contractors and wiremen in this country some particulars of the operation of the scheme in force in New Zealand may be of interest. These are taken from a recent issue of the *New Zealand Electrical Journal.*

The Electrical Wiring and Supply Regulations are issued under Section 319 of the Public Works Act, which is intended to regulate the generation and utilisation of electrical energy to ensure the safety of the public. The Electrical Wiremen's Registration Act is intended to control the persons who carry out electrical wiring work and these persons are required to work to the standards set by the regulations issued under the Public Works Act.

Formerly the Electrical Wiring Rules issued by the Council of Fire Underwriters were used. Some individual supply authorities, however, had their own wiring rules and wiremen were generally licensed by each authority for work in its district. Considerable variation existed, both in the standards of work required and the examinations. If a wireman were possessed with a wandering spirit and desired to work at his trade in any district in which he happened to stop, he had to obtain a licence from that local authority. It was not an infrequent occurrence for a wireman who travelled through the country to be in possession of over twenty licences.

One Dominion Standard

When the regulations under the Public Works Act and the Electrical Wiremen's Registration Act came into force the regulations governing the generation, transmission, distribution and use of electrical energy and the issue of licences were vested solely in central bodies, with the result that there is now one standard for the whole of the Dominion. The Electrical Wiremen's Registration Act is administered by the Minister of Public Works who appoints the members of the Registration Board. This consists of the chief electrical engineer of the Public Works Department, or his deputy, and four other members, one from the electrical workers, one from the electricity supply authorities, one from the electrical traders and contractors and one from the fire and accident underwriters. An officer of the Public Works Department is appointed Registrar, and he keeps the necessary registers and records.

As its title suggests, the Act is concerned with the registration of wiremen (either full or limited) and inspectors, the necessary qualifications for registration and the standard of examinations. It also provides for penalties in the case of a breach of its provisions by either registered or non-registered persons and for disciplinary measures for bad work in the case of registered men. The Regulations issued under the Act provide for its efficient working and include the definition of electrical wiring work for the purposes of the Act. The Board cannot exercise powers outside its constitution and is concerned only with persons who carry out or desire to carry out electrical wiring work. Meetings are usually held every month. The Regulations issued under the Act have recently been amended and reissued and are known as the Electrical Wiremen's Registration Regulations, 1940.

Administration of Regulations

The Registration Act is concerned only with who shall do electrical wiring work, whereas the Regulations issued under the Public Works Act deal with how the work is to be done. The Electrical Wiring and Supply Regulations, 1935 (each of which have been twice amended since 1935) are administered by the Public Works Department through the office of the chief electrical engineer. To assist and advise the Department in the making and administration of these Regulations an Electrical Regulations Advisory Committee was appointed by the Minister of Public Works. This committee consists of ten members from the Public Works Department, Post and Telegraph Department, Railways Department, electrical traders and contractors, electrical workers, fire and accident underwriters and electricity supply authorities.

Questions which arise regarding the meaning or intent of any regulations are referred to this committee and its opinions are published in "Interpretation Circulars" usually issued once a month. These interpretations are distinct from amendments as they explain the existing regulations and are not alterations to them.

Confusion is sometimes caused by the fact that the Electrical Wiremen's Registration Act and the Electrical Supply and Wiring Regulations are administered under the control of the chief electrical engineer, but the Electrical Wiremen's Registration Board is an entirely separate branch of his office and the registration, examinations for, and control of persons doing electrical wiring work are dealt with apart from the business concerning the electrical wiring and supply authorities. For convenience, however, and due to the close relation of the work involved, certain officers are engaged partly on Registration Board business and partly on the administering of Electrical Supply and Wiring Regulations.

New Zealand Electrical Imports

THE annual statement for 1939 of the foreign trade of New Zealand has just reached this country. From it the following figures showing the imports of electrical goods into the Dominion have been extracted and notes added of increases or decreases compared with 1938. It will be seen that decreases predominate.

Preliminary statistics for 1940 show that the decline in the electrical trade which took place in 1939 continued in that year. The total value of electrical machinery and equipment imported in 1940 is given provisionally as £2,262,000, a fall of £250,000 on the previous year. This total does not include wireless apparatus, which was imported to the value of £253,000 in 1940, against £250,000 in 1939.

	1939 £N.Z. (000)	Inc. or dec. on 1938 £N.Z. (000)
Storage batteries—		
Total	20	− 29
From United Kingdom	17	− 2
,, Australia	1	− 21
Parts of storage batteries—		
Total	40	− 17
From United Kingdom	6	− 1
,, Canada	1	− 3
,, Australia	28	− 9
Other batteries and cells—		
Total	41	− 22
From United Kingdom	11	− 4
,, Canada	14	− 8
,, Australia	9	− 11
Carbons or electrodes for arc lamps or for electric welding—		
Total	22	− 5
From United Kingdom	15	− 4
,, Australia	1	—
,, Canada	3	+ 2
Vacuum cleaners—		
Total	128	− 13
From United Kingdom	102	+ 28
,, Canada	1	− 2
,, Germany	3	− 4
,, Sweden	19	− 33
,, United States	1	− 1
Insulated wire and cable—		
Total	446	− 6
From United Kingdom	411	− 11
,, United States	9	—
,, Canada	7	+ 3
Insulators—		
Total	10	− 36
From United Kingdom	7	− 18
,, Canada	2	− 10
Filament lamps—		
Total	144	− 40
From United Kingdom	135	− 35
,, Holland	1	− 3
,, United States	7	− 1
Other electric lamps—		
Total	43	− 16
From United Kingdom	21	− 1
,, Germany	5	− 4
,, Japan	2	− 4
,, Australia	1	—
,, United States	8	− 3
Electric ranges—		
Total	81	− 42
From United Kingdom	62	− 17
,, Canada	19	− 26
Other electric cooking and heating appliances—		
Total	41	*
From United Kingdom	31	*
,, Canada	2	*
,, Australia	4	*
Radio receiving sets mounted in cabinets—		
Total	105	− 75
From United Kingdom	101	− 50
,, United States	3	− 19
Radio receiving sets built up but not in cabinets—		
Total	8	− 50
From United States	4	− 24
,, United Kingdom	2	− 7
Radio valves—		
Total	66	− 7
From United Kingdom	20	+ 3
,, Holland	6	+ 4
,, United States	39	− 12
Other radio apparatus—		
Total	104	− 15
From United Kingdom	25	− 9
,, Holland	1	—
From United States	37	− 9
,, Australia	38	+ 4
Other telegraph and telephone apparatus—		
Total	329	− 66
From United Kingdom	240	− 88
,, United States	14	− 5
,, Australia	9	+ 6
Electric irons—		
Total	11	*
From United Kingdom	4	*
,, Australia	3	*
Other electrical apparatus (dutiable from British sources)—		
Total	84	−130
From United Kingdom	46	− 83
,, Germany	3	− 3
,, Canada	4	− 9
,, United States	14	− 15
,, Japan	1	− 1
,, Australia	14	− 18
Other electrical apparatus (duty free if British)—		
Total	800	− 18
From United Kingdom	581	− 8
,, Canada	21	+ 2
,, Germany	32	+ 15
,, Sweden	29	− 14
,, United States	75	− 15
,, Australia	44	+ 8
Motors and parts—		
Total	256	− 5
From United Kingdom	147	+ 12
,, Germany	5	—
,, United States	48	− 27
,, Canada	40	+ 11
,, Sweden	9	+ 3
,, Switzerland	1	− 4

* Comparative figures not available.

COMMERCIAL and INDUSTRIAL NEWS

Mutual Assistance Groups. Iron and Steel Control Extended.

Controlled Establishments

BY an Order in Council made last week (S.R. & O. 1023) a further step is taken in the exercise of powers in controlled industrial establishments. The Order provides that any person with managerial authority in such establishments may be removed or replaced if he is "acting or has acted in such a manner as to obstruct the authorised controller in the performance of his functions." A person so removed will not be allowed to take up another position with the same company without permission.

It is also provided that if the competent authority deems it expedient an Order for the transfer of a controlled company's shares to nominees may be made with the consent of the Treasury. The price paid for shares will be not less than the value as between a willing buyer and willing seller at the date of the Order.

Mutual Aid

Under the auspices of the British Electrical Development Association forty-eight groups of electricity supply undertakings have been formed for the purpose of rendering assistance to one another in the event of damage to any of the undertakings being caused by enemy action.

Schedules have been circulated to undertakings giving operational instructions, the names and particulars of principal technical officers, details of transport and man-power available and particulars of cable, switchgear, transformers and other material available, and a liaison officer has been appointed for each group.

Power Station Coal Costs

The July *I.M.E.A. Journal* states that the Central Electricity Board has under consideration the effect of war conditions upon the operation of selected stations throughout the country and the problems which arise in those cases in which generating plant is damaged or destroyed by enemy action. It feels that some common action is desirable to spread the incidence of war conditions in some equitable manner, rather than let it lie where it chances to fall. The Board has therefore prepared a memorandum on the increased cost of fuel per kWh sent out and this is now receiving the careful attention of the I.M.E.A.

The question of coal supplies is said to be still receiving the earnest attention of the I.M.E.A. Council and the Conjoint Conference of Public Utility Associations and everything possible is being done. It is hoped that the matter will reach a successful conclusion without undue delay.

Irish Lamp Quota

The United Kingdom Trade Commissioner at Dublin has forwarded to the Board of Trade a copy of the Control of Imports (Quota No. 31, Eleventh Period) Order, 1941, which appoints the period August 1st, 1941, to July 31st, 1942, as the eleventh period under the Order relating to certain electric filament lamps and fixes the quota for that period at 100,000 articles.

Iron and Steel Control

The Ministry of Supply has issued the Control of Iron and Steel (No. 15) Order, 1941, which came into force on July 17th, and revokes the Nos. 8, 10, 11, 12 and 13 Orders.

The principal alterations under the Order are:—(1) The incorporation in the distribution of steel supplies scheme of all iron products, except pig iron but including iron castings, with effect as from September 1st next. It will be necessary for all then existing orders to have been authorised by the responsible Government Departments at that date. For the period to August 31st next the Direction No. 1 issued with the Order, maintains the present arrangements for licensing of iron products; (2) The prohibition of the treatment, use and consumption without authority, of iron and steel in the production, repair or maintenance of articles not controlled under the Order; (3) The quantity and value of material which may be bought by any one customer from stockholding merchants without licence is limited. This supplements the arrangements already in force by which the quantities allocated to stockholders are rationed.

In addition, the control is extended to cover iron powder, carbon graphite electrodes, and anodes, except illuminating and welding qualities, and petroleum coke. The maximum prices fixed under the Orders are, in the main, unaltered, but minor adjustments and additions have been made in the schedules.

Copies of the Order, including Direction No. 1, may be obtained from H.M. Stationery Office, York House, Kingsway, W.C.2, or through any bookseller.

Steel for Hand Tools

All applications for authorisations for the purchase of steel for hand tools should henceforth be addressed to the Directorate of Hand Tools, The Cedars, Tettenhall, Wolverhampton.

Organisation of Production

Details are given in the *Board of Trade Journal* of the arrangements to improve production organisation, which were recently announced in the House of Commons by the Minister of Labour. Area Boards are to be renamed the Production Executive's Regional Boards and their functions and duties have been extended. These will include arranging interchange of machine tool capacity to relieve overload and to expedite production; suggesting remedial action in regard to firms that may become overloaded with a multiplicity of contracts; advising the Regional Controller of Factory and Storage Accommodation on providing and allocating factory accommodation; bringing to the notice of the appropriate authority any transport difficulties whether of workers or of goods, and receiving their co-operation; bringing to attention raw materials difficulties; explaining through trade unions, and employers' associations' representatives, the production difficulties which give rise to discontent.

Capacity Clearing Centres are to be set up by the Regional Boards where necessary.

Industrial Discipline

An amendment to the Essential Work (General Provisions) Order provides that workers in factories engaged in important Government work who are suspended for breaches of discipline for periods of not more then three days shall not be paid for the period of suspension. They are, however, given the right of appeal to the Local Appeal Board.

Concentration of Industry

In the House of Commons on July 15th, in a written reply, the President of the Board of Trade said that the invitation to conclude agreements for concentration of industry contained in the White Paper of March last had evoked a satisfactory response. Altogether, nearly 110,000 workers had been released, or were being made available for release under arrangements now in hand in the industries concerned. About 16,500,000 sq. ft. of factory space had been placed at the disposal of the Controller-General of Factory and Storage Premises, a considerable proportion of which would be immediately available for war production or storage dispersal purposes. The period allowed for the submission of voluntary schemes on the basis prescribed in the White Paper had now come to an end. In a number of the lesser industries the results aimed at had been substantially achieved and gratifying progress had been made in large sections of the more important industries affected by the Limitation of Supplies Orders or by the rationing of raw materials. The Board of Trade, in conjunction with other interested Departments, was now hastening the completion of the measures by itself nominating nucleus firms. The application of this policy of concentration to other industries than those originally specified must depend to an important extent on whether the industry was one in which there was substantial surplus capacity, and in which concentration would release a substantial amount of labour or factory space useful for war purposes.

War Damage Bill

Under the War Damage Act payments may only be made in respect of a "risk period" which ends on August 31st next. To ensure that payments are continued for another year the Chancellor of the Exchequer last week introduced the War Damage (Extension of Risk Period) Bill. This will make no change in the amount of contributions payable under the present Act; those payable for the second risk period provided by the new Bill will be determined when more comprehensive legislation is considered later, and until then the only contribution to be collected will be the 2s. in the £ on the net Schedule A or rateable value of property payable each year for five years from July 1st last to cover compensation during the first risk period. Later legislation will also deal with the special war damage scheme for public utilities.

Canadian Restrictions on Consumption

The Ottawa Correspondent of *The Times* reports that the Canadian Government has reached the conclusion that the further expansion of the industrial war effort demands sacrifices on a more general scale from the civilian population through additional restrictions on consumption. There is under consideration a sharp reduction and possibly a complete ban on instalment buying and a drastic curtailment in the production of articles such as radio receivers, washing machines, electric stoves, and fixtures, while the threatened shortage of power for war industries is likely to result in a reduction of lighting in streets and shops.

L.P.T.B. Shift Workers' Wages

The Electrical Trades Union recently put in a claim for an increase of 1d. per hour in the wages of shift workers employed by the London Passenger Transport Board. The matter went before Sir John Forster as arbitrator, and he has awarded a special shift allowance of 10d. per 16-hour shift to the electrical wages staff employed in the Greenwich power station, the tram and trolley-bus substations of the Board, on high-voltage cables between them, and in the tram and trolley-bus distribution section.

Equipment for Palestine

A firm of electrical engineers in Tel-Aviv, Palestine, desires to get into touch with manufacturers of DC and AC motors in sizes from ¼ to 60 HP who are not already represented in Palestine. The firm is also interested in flex and bakelite accessories (Edison screw lampholders and adaptors, etc.). We shall be pleased to pass on communications from manufacturers who would like to get into touch with our correspondents.

An Inquiry from South Africa

A large well-established South African firm would like to represent British manufacturers of domestic electrical appliances and radio apparatus. We shall be pleased to forward letters from anyone interested.

Fatalities

Verdicts of accidental death were recorded at an inquest held on July 16th, in Manchester, on James Liggett (41) and James Morton (32) who died as a result of an explosion and fire at a Manchester Corporation power station. It was stated that Morton and Liggett were working in a switch-house altering the gear to provide for the handling of more load A pair of pliers, which Morton had been using was found, and it was thought that possibly these were the cause of the shock which resulted in his death and also began the explosions and fire.

While fitting cables at the Sheffield power station on July 14th, George Holdcroft (37) received a fatal electric shock.

An inquest was held at Sheffield last week

on George William Holdcroft (33), an overhead linesman. Mr. H. W. Sewell, second assistant transmission engineer, C.E.B., said that a gang of Leeds men was sent to Sheffield to work on an overhead cable at a power station. While he was in his office at Leeds a Sheffield circuit tripped out and, fearing that there had been an accident, he went to Sheffield. He found that Holdcroft had been killed through going up a pylon to work on the wrong circuit. A mistake had been made in the issue of coloured discs. The deputy coroner recorded a verdict that Holdcroft met his death accidentally while at work by coming into contact with a live cable. The accident was caused through a mistake in issuing coloured discs and a permit incorrectly directing him to work on a circuit known as "B," which was live, instead of "A" circuit, which was isolated, earthed and safe. At least with two persons in this case the human element had failed. He hoped that as a result of the fatality the safeguards provided would be strengthened and other tests made available for the future.

Australia to Produce Radiolocation Equipment

Production of radiolocation equipment in Australia is to begin immediately. Mr. J. McEwen, Commonwealth Minister for Air and Civil Aviation, announced on July 14th. The equipment will be for local use and thousands of persons will be employed.—*Reuter* (Melbourne).

Chart of British Aircraft

A pocket identification chart of British aircraft containing twenty-four copyright studies on two celluloid cards, eyeletted together for ease of examination, has just been published by *Flight*. The characteristics of each type are noted to permit ready recognition and the twenty-four silhouettes are supplemented by seventy-five line diagrams depicting broadside, head-on, overhead- and under-side aspects of leading types. The chart is available from *Flight*, Dorset House, Stamford Street, London, S.E.1, price 1s. 6d. post free.

Standardised Electric Vehicles

In order to meet wartime conditions, Associated Electric Vehicle Manufacturers, Ltd., announce the standardisation of Morrison-Electric and Electricar battery vehicles to four types. The Morrison Electric range will comprise 10- and 20-cwt. utility vans and a 40-cwt. flat-deck vehicle, while a flat-deck 50-cwt. model will be the sole representative of the Electricar vehicles. All of them will have pressed steel frames and series traction motors with solenoid contactor type controllers giving three speeds, hand-operated reverse switches being provided. The two smaller vehicles are fitted (unless specified) with standard Young batteries comprising respectively 30 and 36 cells, type "SATR 17," 216 Ah, giving 30–35 miles per charge with average half load and approximately 100 stops and starts. Each of the larger vehicles has 40 cells, type "SATR 23," 297 Ah, giving 35–40 miles per charge.

American Electrical Industry Restrictions

According to reports from authoritative quarters, pressure on electric light and power companies to extend their programmes for expanding capacity and installing more interconnections with adjoining systems to assure adequate power supplies for defence industries may force drastic priorities in the electrical equipment manufacturing field to cope with the turbine demands of both the utility industry and shipping learns *Reuter's Trade Service* from New York. Reports of the Federal Power Commission and the Office of Production Management, indicating the urgency of additional power facilities, will undoubtedly be used as a basis for expanding Government projects, it is stated. Moreover the private utility industry is formulating plans for a more careful allocation of orders.

According to equipment makers, production of turbines for both utilities and ships has so far been running on schedule. But certain shortages of material and specialised labour, it is expected, will require stricter planning as regards non-defence activities. This may mean the enforced curtailment of production in household and other "non-essential" appliances, affecting not only the big manufacturers but also smaller concerns, which would then be given sub-contract orders for parts or small turbines. It is hoped that the re-arrangement of orders to stress direct defence requirements will eliminate further expenditure by equipment manufacturers on more machinery and plant which would be a drag in the post-emergency era. But the experience of the steel industry, which Washington has suggested should expand capacity rather than reduce normal supplies more drastically, is regarded as foreshadowing similar pressure in the electrical field.

Chilean Export Ban

A *Reuter* message from Santiago states that the export or re-export of a great number of raw materials considered essential for the Chilean nation's activities is banned under a decree issued on July 16th. The list includes aluminium, tin, iron, nickel, lead, zinc, asbestos, mica, petroleum, rubber, silk, cotton, jute, copra, yarns of cotton, linen, silk and jute, and sacking. The export of electrical material for aeroplanes, machinery and various parts, and industrial acids and salts is also banned.

Unlawful Consumption at Stoke

A fine of £5, with special costs of one guinea, was imposed by the Potteries Stipendiary Magistrate (Mr. Macgregor Clarkson), at Stoke-on-Trent, on Albert Edward Evans, of 18, Hulse Street, Fenton, a miner, who was summoned for unlawfully consuming electricity between March 3rd and June 11th. Defendant pleaded guilty. A Corporation electricity meter inspector stated that when the meter at defendant's home was emptied a total of 20s. and four circular pieces of tin, each approximately the size of a shilling were found. The meter register was set at £1 4s. Mrs. Evans offered no explanation of the substitute coins, nor did she offer to make good the deficiency. Evans stated that the substitute coins were placed in the meter by his wife because, at the time, she was unable to obtain shillings. She thought that the deficiency could be met out of the rebate on the meter contents. Mr. J. Mee (prosecuting) said that Evans had twice been warned regarding the placing of substitute coins in his meter, and on different occasions, a total of 29 such coins had been recovered from his meter.

Valves for "Talkie" Equipment

Inquiries have been made by the Cinematograph Exhibitors' Association as to the use of valves in talking equipment in the cinemas of this country. The analysis shows that there are 397 types of valves in use that are designated by a code classification, and the estimated requirements for replacements during the forthcoming twelve months total 35,826. This information has been forwarded to the appropriate Government Department.

Atlas Lamp Showcard

"See Better with Atlas: Up to 20 Per Cent. More Light" is the message of a clever new Atlas lamp showcard now being distributed to the trade. It represents a large portrait of a cat whose eyes have lamps instead of pupils, indicating the function of the Atlas lamp, like the cat's eye, of permitting its possessor to see in the dark. Readers will remember that the manufacturers of the lamp recently inaugurated for the benefit of factory and office managers a new scheme providing the services of an illuminating engineer to plan proper lighting in conformity with the legal standards now laid down.

A.O.E.C. Annual Meeting

The annual meeting of the Association of Officers and Staff Members of Electricity (Power and Supply) Companies of Great Britain was held in London on May 16th, Mr. J. J. Lesser, chairman of the Executive Committee, presiding in the absence of the president, Brig.-Gen. R. F. Legge. Mr. Lesser, in submitting the accounts for 1940, mentioned that there was a surplus of £23, as compared with £7 for the previous year. In spite of the various drawbacks which the difficult times had created, their membership was keeping steady, but they must put forward every effort to retain and to attract new members. While general electrical legislation was now out of the question, there was little doubt that when the war was over the consolidation in some way or other of the industry would be taken in hand, and it was when these changes were made that the effect on the staff would come into operation. The existence of the Association with sufficient funds to protect its members would then be of great importance.

Brig.-Gen. R. F. Legge was re-elected president of the Association for the ensuing year and Mr. J. W. Leach was elected a vice-president in addition to the re-election of the present vice-presidents.

Engineering Cinematography

Motion picture equipment specially devised for scientific and engineering recording purposes is manufactured by W. Vinten, Ltd., North Circular Road, Cricklewood, London, N.W.2. The camera is driven by a 4-HP motor in conjunction with a heavy fly-wheel, their power being transmitted through a friction clutch and three-speed gearbox, with provision for lubricating all parts under pressure. An unusual type of tachometer is employed for indicating the speed at which photographs are taken. A tuning fork controls a high-voltage electric spark which is focused on to the edge of the film just above the camera gate. Thus if the fork were adjusted to vibrate at the rate of 2,000 periods per second and five spark images appeared in three successive frames, it would be evident that each individual frame had been exposed for 1/1200th part of a second.

Trade Announcement

Leslie Dixon & Co. inform us that, following the destruction of their London showrooms and offices they have now taken new premises adjoining their works at 19, Broughton Street, Battersea, London, S.W.8.

New Catalogues and Lists

Engineering Utilities, Rosedale Works, Rosedale Road, Richmond, Surrey.—A leaflet giving details of the new "Euco" micrometric attachment designed for use on automatics, capstans and turret lathes.

The British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2.—A price list of "Mazda" miners' bulbs for cap lamps and hand lamps.

TRADE MARK APPLICATIONS

THE following applications have been made for British trade marks. Objections may be entered within a month of July 16th:—

ACTARC. No. 614,878, Class 7. Arc welding machines and parts thereof, and machine tools for use in connection therewith.—International Welding Co., Ltd., 2, South Parade, Bedford Park, London, W.4.

CONCORD. No. 613,790, Class 9. Aerials for wireless telephony, telegraphy and television; electric flexibles, wires and cables for electric transmission systems, and electricity conductors.—The Concordia Electric Wire Co., Ltd., Trent Mills, Derwent Street, New Bawley, Long Eaton, near Nottingham.

CHRONTACTOR. No. 614,840, Class 9. Timing devices for use in connection with electric switches and electric regulators.—Contactor Switchgear, Ltd., Moorfield Road, Upper Villiers Street, Wolverhampton.

JAMES WATT (design). No. 614,941, Class 11. Installations for heating, lighting and ventilating.—G. N. Haden & Sons, Ltd., 19/29, Woburn Place, London, W.C.1.

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding makers of the following:—

Vacuum smelted sheet iron suitable for neon sign electrodes.

ELECTRICITY SUPPLY

South Wales Company's Capital. Tiverton Charges Reduced

Barrow-in-Furness.—MAINS EXTENSION.—The Corporation Electricity Committee is to extend mains to supply certain premises.

Billingham - on - Tees. — UNDERGROUND CABLES.—The Urban District Council is not to offer any objection to a proposal by the North-Eastern Electric Supply Co., Ltd., to lay underground cables in the area.

Birmingham.—PURCHASE OF LAMPS.—The Corporation Emergency Committee is to purchase 10,000 electric lamps for wardens at a cost of £1,250.

Burton-on-Trent.—FRINGE ORDER.—The Corporation Electricity Committee is seeking a Fringe Order to supply premises within the area of the West Midlands Joint Electricity Authority.

EXTENSIONS.—The Committee is to provide supply to certain premises and extend mains.

Eire.—BOARD'S ANNUAL REPORT.—A substantial increase in sales of electricity other than for traction is recorded in the annual report of the Electricity Supply Board for the year ended March 31st last. The net gain, allowing for a decrease of 5.3 million kWh in traction supplies, was 26.7 million kWh, raising the total to 345.2 million kWh. An additional 11,202 consumers were connected during the year, making altogether 183,747. We hope to deal more fully with the Board's report in our next issue.

Fleetwood. — ELECTRICITY CHARGES. —The Town Council has intimated that if there is a further advance in fuel charges the existing electricity tariff will have to be revised to avoid a loss on the working of the undertaking.

London.—INCREASED NORTHMET CHARGES. —The Northmet Power Co. is notifying an increase in standing charges of 2s. 6d. a quarter as from the termination of existing agreements with a minimum of 7s. 6d. a quarter. To cover increased costs the company is also making a minimum charge of 2s. 6d. exclusive of materials, for service calls, and is to increase the nominal charge for fuse renewals from 1s. to 1s. 6d.

London.—HAMMERSMITH.—The Executive and Civil Defence Committee has received sanction from the Electricity Commissioners to the borrowing of £3,618 for the interconnection of e.h.v. substations.

Manchester.—COAL POSITION EASIER.—It was reported at a meeting of the Electricity Committee last week that the coal position was now slightly better. The Electricity Department, which had been drawing on its reserves since last October, was no longer drawing from stock. The increased supplies were being received from more distant coalfields and at a substantially increased cost.

Portland. — NEW TRANSFORMERS. — The U.D.C. Electricity Committee is to install larger transformers at a substation.

Reigate.—POSITION OF UNDERTAKING.—Reporting on the position of the Electricity Department at a recent meeting of the Council, Alderman W. L. Lorkin, chairman of the Electricity Committee, said that the undertaking's tariffs were among the lowest in the country. Every possible economy had been made in internal working, costs and expenditure for the year ended March 31st last had actually been less than in 1939–40, although considerable sums were spent in making up the pay of employees on war service and in part of the legal costs of the Committee's income tax appeal. A net loss was anticipated on the current year's working. Alderman Lorkin remarked that the undertaking was one of the largest ratepayers in the borough, and recalled that he had referred previously to the basis of computing these rates. He was afraid that it was not sufficiently well known that this charge for rates, although helping the borough financially, had ultimately to be borne by the electricity consumer.

South Wales.—POWER COMPANY'S CAPITAL INCREASE.—The text has now been published of the draft Special Order made by the Electricity Commissioners authorising the South Wales Electric Power Co. to raise additional capital not exceeding in total one million pounds, and raising the company's borrowing powers by a similar amount. The exercise of the new powers remains subject to the consent of the Treasury.

It will be recalled that the Electricity Commissioners sought to impose conditions on the issue of new capital by the company (ELECTRICAL REVIEW, May 30th, p. 700), but a King's Bench Divisional Court, on the company's application, ruled that the Commissioners were acting *ultra vires*.

Tiverton.—CHEAPER ELECTRICITY.—In view of the satisfactory financial position of the electricity undertaking the Town Council last week decided to reduce the charges in accordance with a recommendation of the Gas and Electricity Committee. From the next quarterly meter readings there will be a reduction of ¼d. per kWh under the flat rate (except special flat rate) and two-part tariffs and of 0.15d. per kWh for industrial bulk supplies.

Workington.—DEVELOPMENT EXPENDITURE. —The Town Council is to proceed with electrical developments costing £3,385.

TRANSPORT

Tasmania. — LAUNCESTON TRAMWAYS. — Trams are the chief means of passenger transport operated by Launceston City Council and during the year ended June 30th, 1940, they carried 4.8 million of the total of 5.4 million passengers. The annual report of Mr. R. J. Strike, superintendent, shows that traffic receipts were £43,987 on 559,431 vehicle-miles, giving an average revenue of 18.871d. per vehicle-mile. Operating expenses amounted to £41,099 (17.631d. per vehicle-mile). After taking into account sundry other revenue and meeting interest, etc., charges there was a net deficit on the trams of £7,939 which, with a deficit of £1,220 on the motor-buses, gave a total loss of £9,159. After deducting this from £10,171 " revenue from rating " the surplus of £1,012 was transferred to reserve.

CORRESPONDENCE

Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publication. The Editors cannot accept responsibility for correspondents' opinions.

Chief Engineers' Salaries

REFERRING to Alderman Walker's letter in your recent issue, I wish to pay my compliment to the good work which he, and even some of the engineers on the A.M.E.E. have done to standardise chief engineers' salaries. But it is necessary to face the criticism arising from so many quarters that the failure which has occurred in obtaining agreement to the new salary schedule is due almost entirely to the anomalous actions and constitution of the A.M.E.E.—the organisation which should have been instrumental in obtaining that agreement. Just consider a few of the anomalies.

After pressure from outside (and from the employers) the A.M.E.E. has reluctantly agreed to bring into the salary schedules those undertakings with outputs up to 5,000,000 kWh per year. I maintain that it is for the chief engineers of these undertakings that the A.M.E.E. should have devoted its main efforts and not to ensuring that my salary and those in similar large undertakings are increased.

Even the most Machiavellian of the Association's supporters must consider the anomaly of some of the chief members who hold office, and I am afraid descend to the use of execrable methods to their fellow sinners without the pale. Some of these members willingly took their present positions at salaries very considerably below the schedule, and, in one case, despite the fact that the appointment was twice blacklisted. Yet these same members propose to limit the new schedule exclusively to the benefit of those within the Association.

A critical point has been reached—the Association would appear to be on the verge of dissolution. Personally I think this dissolution is inevitable and that it springs from within the Association which has become autocratic and selfish. I believe that the new schedule will not be accepted, because of the present constitution and administration of the A.M.E.E. I am equally convinced that a new, or reconstructed Association can win the employers' approval and obtain acceptance of the schedule. I think that this new Association can be formed and that the nucleus is already available. I should be pleased to communicate with any other engineer who holds the same view.

J. A. SUMNER,
City Electrical Engineer.

Norwich.

Earth-Leakage Protection

I WAS very interested in Mr. F. E. Butcher's article in your issue of July 11th describing leakage protection for portable tools, and he will know that I share many of his views regarding the unsuitability of ordinary earthing for this purpose. Mr. Butcher omits to state another reason for this—the risk of damage to the tool. I should like further information, however, and perhaps Mr. Butcher will deal with the following points :—

(1) Would not the interposition of the double-wound transformer of itself afford all necessary protection, as the tool thereby becomes insulated from the supply earthed-neutral point ?

(2) In his account of the test room arrangements, Mr. Butcher describes a method of detecting earth faults. How would his method detect another menace—a discontinuous earth conductor in the flexible cord ?

(3) At what point in the circuit are the three-pin sockets installed, and is it not true that the flexible cords do not share the test afforded by the test buttons ?

Taking these points into account, I am of the opinion that Mr. Butcher would obtain a greater measure of protection by the use of leakage trips in the orthodox manner, the additional cost of the transformer being avoided.

T. C. GILBERT.

Cambridge.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specifications (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1939

28021. "Section insulators, insulated approaches and the like for overhead lines for trolley buses and the like." R. Livingstone and Anti-Attrition Metal Co., Ltd. October 17th, 1939. (Cognate application, 1091/40). (537580.)

29501. "Electric power transmission systems." British Thomson-Houston Co., Ltd. November 5th, 1938. (537581.)

29584. "Absorption refrigerating systems." Electrolux, Ltd. December 22nd, 1938. (537507.)

30529. "Mountings for electric fittings." V. G. Bull and British Power Boat Co., Ltd. November 21st, 1939. (537471.)

30755. "Electrical transformers." E. Fries. November 26th, 1938. (537609.)

32267. "Electric cables." J. Gray. December 14th, 1939. (537511.)

32474. "Heat-treatment of aluminium base alloys." British Thomson-Houston Co., Ltd. December 23rd, 1938. (537512.)

32674. "Electric circuit-breakers of the gas-blast type." A. Reyrolle & Co., Ltd.' F. Coates and A. Allan. December 21st, 1939. (537482.)

32733. "Electrical method and apparatus for analysing gaseous mixtures." J. G. Fife (Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij). December 22nd, 1939. (537486.)

32776. "Shades or screens for lighting devices." C. S. Parsons (C. Hellegers). December 22nd, 1939. (537487.)

32777. "Thermal maximum demand indicator." Landis & Gyr Akt.-Ges. August 23rd, 1939. (537488.)

32814. "Electron-discharge apparatus of the velocity modulated type." Standard Telephones & Cables, Ltd., and J. H. Fremlin. December 22nd, 1939. (537518.)

32815. "Electron-discharge apparatus." Standard Telephones & Cables, Ltd., and J. H. Fremlin. December 22nd, 1939. (537490.)

32816. "High-frequency electron-discharge apparatus." Standard Telephones & Cables, Ltd., and J. H. Fremlin. December 22nd, 1939. (537491.)

32817. "Electron-discharge apparatus." Standard Telephones & Cables, Ltd., and J. H. Fremlin. December 22nd, 1939. (537492.)

32818. "Crystal controlled oscillator particularly for ultra-high frequencies." Standard Telephones & Cables, Ltd. January 5th, 1939. (537546.)

32860. "Automatic switches used in telephone or like systems." Automatic Telephone & Electric Co., Ltd., and E. E. Comfort. December 27th, 1939. (537614.)

1940

373. "Electrical vibrating devices for converting direct-current to alternating-current." R. H. Dent and H. W. Pook. January 6th, 1940. (Cognate application, 5703/40.) (537623.)

576. "Electrical ignition systems of internal-combustion engines." American Bosch Corporation. April 25th, 1939. (537520.)

1528. "Contacts for electric circuit-breakers, switches, connectors, and the like." Whitehead Switchgear & Inventions, Ltd., and G. E. Whitehead. January 25th, 1940. (537522.)

1618. "Microphones." G. R. Fountain, Ltd., G. R. Fountain, A. E. C. Snell and H. J. Houlgate. January 26th, 1940. (Addition to 507183.) (537524.)

1875. "Radio direction finders." Marconi's Wireless Telegraph Co., Ltd. January 30th, 1939. (537626.)

1876. "Bearing indicators for radio compasses." Marconi's Wireless Telegraph Co., Ltd. January 30th, 1939. (537627.)

2532. "Short-wave transmitters." Standard Telephones & Cables, Ltd. March 22nd, 1939. (537530.)

3477. "Electrostatic vibrating devices." D. E. L. Shorter and C. G. Mayo. February 23rd, 1940. (537554.)

3767. "Voltage regulating systems employing on-load tap-changing switchgear." Ferranti, Ltd., and J. Hargreaves. February 29th, 1940. (537556.)

3871. "Linear thermionic amplifying systems." Standard Telephones & Cables, Ltd. May 13th, 1939. (537558.)

4121. "Backing devices for use in electric welding operations." W. R. Hume. March 5th, 1940. (537559.)

4306. "Sound-recording apparatus." Radio Corporation of America. March 31st, 1939. (537635.)

4365. "Joint boxes for connecting and disconnecting electric cables." Callender's Cable & Construction Co., Ltd., F. Moor and F. C. Hogg. March 8th, 1940. (537636.)

4843. "Electromagnetic bells." Ericsson Telephones, Ltd., and H. J. Melton. March 15th, 1940. (537568.)

5570. "Lighting-apparatus embodying high-pressure metal-vapour electric discharge lamps." Ferranti, Ltd., M. E. Sions and A. L. Chilcot. March 28th, 1940. (537573.)

5604. "Absorption refrigerating systems." Electrolux, Ltd. June 21st, 1939. (Addition to 537507.) (537536.)

5974. "Circuits for operating the indicating devices of electrical safety devices." British Thomson-Houston Co., Ltd., and T. H. Petch, jun. April 3rd, 1940. (537639.)

7672. "Low-reflectance glass." British Thomson-Houston Co., Ltd. April 28th, 1939. (537591.)

8449. "Web-guide for printing telegraphs and like machines." Creed & Co., Ltd. July 13th, 1939. (537643.)

8639. "Recording blanks for electric recording in facsimile telegraphy." Creed & Co., Ltd. (Western Union Telegraph Co.). May 14th, 1940. (537593.)

9066. "Pole-piece assemblies for telegraphones." Electrical Research Products, Inc. July 13th, 1939. (537595.)

9272. "Stationary electric induction apparatus." British Thomson-Houston Co., Ltd. May 25th, 1939. (537596.)

9297. "Bed-warmer." Belling & Co., Ltd., C. R. Belling and H. M. Hibberd. May 27th, 1940. (537597.)

9842. "Video-frequency signal-translating system." Hazeltine Corporation. June 9th, 1939. (537599.)

14179. "Liquid-blast electric circuit-breakers." British Thomson-Houston Co., Ltd. September 13th, 1939. (537603.)

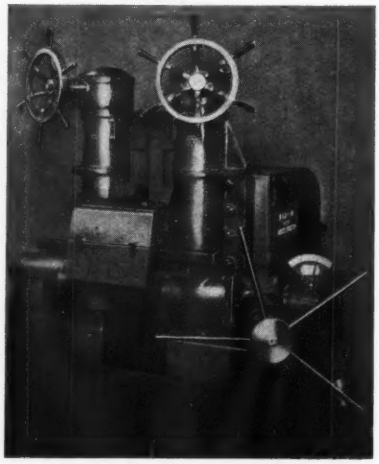
1941

5233. "Electric-power transmission systems." British Thomson-Houston Co., Ltd., November 5th, 1938. (Divided out of 537581.) (537604.)

Flash Butt Welders

HOMOGENEOUS joints in rolled steel sections or tubes can be made both quickly and reliably with flash butt welding machines. Special machines are not required for the preparation of the work prior to welding nor are there any expensive finishing processes.

The method is to bring two butt ends together and separate them several times under the arc of a heavy current, one of the two pieces being held in fixed jaws and the other in movable jaws. Thus projections and impurities are burned away and the faces of the joint brought up to a bright red heat uniformly over their whole areas. At this stage the flashing operation is started immediately by separating the surfaces once again and bringing them together slowly so that a continuous flash is produced from the joint, which is repeated until a pre-determined amount has been burned off the ends of both bars and then the two surfaces are pressed together, or "up-set," under great pressure and the welding current is switched off.



Flash butt welding machine of 120 kVA for colliery roof supporting arches

The strength of this type of welded joint is shown in the repair of colliery roof supports, which consist of 5 in. by 4½ in. H-section steel joists bent to form an arch, the largest being 12 ft. by 9 ft. and the smallest 6 ft. by 6 ft. Damaged arches are removed from the pit, the defective parts cut out, and new lengths of joist bent and then flash butt welded in place of the discarded pieces. The short ends of lengths of joists, which are normally scrapped, can be welded up to make any continuous length required for the construction of new arches. This method of repair of steel roof arches is being used in a number of collieries.

"Metrovick" 120-kVA flash butt welding machines have been installed in the collieries of the Wemyss Coal Co., Ltd., for solid steel sections of from 1 to 8 sq. in. cross-sectional area.

A transformer mounted in the fabricated steel frame of the machine has a water-cooled secondary winding to allow it to be operated indefinitely at its maximum output without overheating. The primary winding is connected to a five-position tapping switch, mounted in the side of the machine. A contactor, mounted in the machine frame and controlled by a foot-switch placed near to the operator's position, is used for switching "on" and "off."

The clamping of the jaws is carried out by handwheels through gear boxes and screw mechanisms so designed that the great clamping pressures necessary for the larger sections can readily be obtained. The detachable copper clamping jaw blocks and the connections from them to the transformer are water-cooled. One set of work clamps is fixed to, but insulated electrically from, the frame, while the other set is free to slide on a circular guide shaft, this movement being controlled by the up-setting handwheel through a gear box and screw. An indicator attached to the gear box gives a direct reading of the horizontal movement and is used during the flashing period to determine the amount of "burn-off." Mechanical and electrical parts likely to be affected by the molten particles thrown out are provided with metal guards.

FINANCIAL SECTION

Company News. Liquidations and Bankruptcies. Stock Exchange Activities.

Reports and Dividends

The General Electric Co., Ltd., in its report for the year ended March 31st, 1941, states that the profits amounted to £1,722,643, to which is added £811,931 brought forward, giving a total of £2,534,574. After deducting depreciation (£444,598), provision for war contingencies (£50,000), directors' fees (£5,064) contribution to pensions fund (£69,313), dividend on " A " preference stock (£62,888), dividend on " B " preference stock (£72,562), and transfer to income tax reserve (£650,000), there remains an available balance of £1,180,149. The directors recommend a dividend of 10 per cent. on the ordinary stock, plus a bonus of 7½ per cent., leaving £812,791 to be carried forward.

Though the company has had a successful year's trading, provision for E.P.T. at 100 per cent. is responsible for a reduction of £170,351 in the net profit. The company's works have been employed to full capacity and a large volume of orders has been received, leaving the order book at the close of the year in a strong position. The Research Laboratories have continued to make an important contribution to the company's success. Export business has been maintained at a high level and all the overseas companies have shown good results, a considerable portion of which, however, has been absorbed by heavier local taxation.

In Australia manufacturing facilities have been extended. The additional finance required for the expansion of the company's activities has been provided by a further loan of £1,000,000, while a sum of £50,000 has been set aside against war contingencies.

In a statement accompanying the report the chairman, Lord Hirst, refers to continued successes in salesmanship, production and research, which, he says, are contributing their full quota to the national effort. The company's numerous factories have all been fully employed and its pay-roll has increased, there now being, including those now serving with the Forces, about 50,000 employees. Despite all difficulties, production has not only been maintained but considerably increased.

Lord Hirst regrets the imposition of the 100 per cent. E.P.T. There is no desire to make additional profits out of the war, but there should be some margin to allow the company not only to deal with that kind of expenditure which, though necessary, is not classed as an allowable expense for taxation, but also to prepare adequately for the vast post-war problems. Research and development, modernisation of plant, and advertisement would require large sums to make good the leeway of war years. It is difficult to-day to foretell what the financial requirements of the future may be, but the directors have already made arrangements under which ample resources will be at their disposal. The company's absorption in the requirements of the home market has not diminished the attention paid to export. In spite of difficulties they have managed to maintain export trade at practically the same level as in the previous year.

The Revo Electric Co., Ltd.—Presiding at the annual meeting held on July 15th, Mr. B. Silcock (chairman) said that his address was being circulated with the directors' report and accounts, instead of being delivered at the annual meeting. Reviewing the accounts, the chairman said that a 100 per cent. excess profit tax, which allowed no margin for the financing of increased production, and with a 10s. income tax, shareholders would appreciate that the directors had to provide for heavy war taxation liabilities, which became due for payment before the relative profits had been collected by the company. The excess profits bore especially heavily on concerns with an ever-expanding programme, as their ratio of liquid assets to production grew less and less. The past year had been one of considerable stress and anxiety, and the chairman paid tribute to the managing directors, works directors and departmental managers and to the workpeople and staff for the service they had rendered. As to the future, he could only repeat what he said last year, that it was the policy of the board to husband as far as possible their resources and increase their efficiency, in the hope that in their own sphere they might worthily play their part.

The British Thermostat Co., Ltd., reports a profit for the year ended January 31st, after tax, of £34,595, as compared with £27,127 for 1939-40. As already announced, it is proposed to pay a final dividend of 11 per cent., again making 18½ per cent. for the year. £4,712 is written off investments and £16,682 is carried forward (against £14 549 brought in).

The Anglo-Argentine Tramways Co., Ltd., reports a loss for 1940 of £33,288, which has been debited to general reserve. The transport undertakings and assets of the company and its subsidiaries form part of the incomplete system which has been operated by the B.A. Transport Corporation since February 16th, 1939. Certain formalities required to give full legal effect to the Corporation's possession of these assets still remain to be carried out; meanwhile issue of certificates for the shares in the Corporation to be received in exchange for transferred assets remains in suspense.

The Engineering & Lighting Equipment Co., Ltd., reports a trading profit for 1940–41 of £58,347, as compared with £54,521 for the previous year. Of this, £39,500 has been reserved for tax and E.P.T. The net profit is £18,468 (against £27,596). The ordinary dividend for the year is maintained at 10 per cent. by the final payment of 4 per cent., and £4,533 is carried forward (against £2,293 brought in).

Christy Bros. & Co., Ltd., report a profit for the year ended March 31st, after deducting depreciation and general expenses, of £20,958, as compared with £19,368 for the previous year. To this is added dividends on investments, £19,296, and fees, £10, and after providing for tax, £5,191, interest on loans, £2,272, employees' superannuation, £1,000, reserve for N.D.C., £500, and placing £10,000 to reserve, it is proposed to pay an ordinary dividend of 11 per cent. (against 10 per cent.) and to carry forward £23,342 (against £23,043 brought in).

Thomas Bolton & Sons, Ltd., report a profit for 1940-41, after taxation, of £161,852, as compared with £183,621 for the preceding year. Of this, £70,000 is allocated to depreciation, £2,521 to directors' remuneration, and £18,000 to debenture interest. The final ordinary dividend is 5 per cent., making 7½ per cent. for the year (against 10 per cent.), and £77,822 is carried forward (against £58,991 brought in).

Hick, Hargreaves & Co., Ltd., report a trading profit for the past year of £111,504 (against £71,294 for 1939-40), and a net profit of £27,063 (against £37,799). The dividend for the year is 7 per cent. (against 5 per cent., and a bonus of 5 per cent.), contingency reserve receives £8,000, and £6,987 is carried forward, as compared with £6,324 brought in.

The Electric Construction Co., Ltd., reports a profit for the year ended March 31st of £92,264, as compared with £57,363 for the preceding year, to which is added £25,459 brought in. Income tax and E.P.T. require £40,000 and A.R.P. £8,000. The ordinary dividend is unchanged at 10 per cent., less tax, £2,500 is transferred to employees' superannuation fund, and £30,223 is carried forward.

The Dubilier Condenser Co. (1925), Ltd., reports a profit for the year ended March 31st of £71,165, as compared with £30,383 for 1939–40. A heavy increase in taxation, however, reduces the net profit from £24,052 to £12,430. Taxation provision is £50,000 (against £11,450 in 1940), and £11,620 is set aside for depreciation. The ordinary dividend for the year is maintained at 10 per cent., and the balance carried forward is £13,477 (against £9,896 brought in).

The Telephone Manufacturing Co., Ltd., reports that net profits for 1940 increased by £19,191 to £70,763. Tax provision absorbed £41,780, and £13,228 has been placed to general reserve. The dividend for the year is unchanged at 9 per cent., and £6,277 is carried forward (against £8,569 brought in).

Bennis Combustion, Ltd., has announced a final ordinary dividend of 5 per cent., maintaining the distribution for the year at 10 per cent.

Enfield Cable Works, Ltd., is again paying an interim dividend of 6¼ per cent.

The Telegraph Construction & Maintenance Co., Ltd., is again paying an interim dividend of 5 per cent.

Crossley Brothers, Ltd., report a net profit for the year to April 30th of £48,808, as compared with £46,970 for 1939–40. General reserve receives £10,000, and the dividend for the year on the deferred ordinary shares is again 5 per cent. The balance carried forward is £34,815 (against £32,885 brought in). No amount has been charged against profits for E.P.T. or N.D.C. as the company's reserve for taxation is considered more than sufficient to meet any liability.

Crossley-Premier Engines, Ltd., report a net profit, after tax, for the year to April 30th last, of £26,629, as against £26,733 for the previous year. The general reserve again receives £5,000, and the ordinary dividend for the year is unchanged at 10 per cent. The balance carried forward is £6,505 (against £6,626 brought in).

The Singapore Traction Co., Ltd., has announced an interim dividend of 2½ per cent. (unchanged).

The Cawnpore Electric Supply Corporation, Ltd., has placed privately 118,500 £1 ordinary shares. Proceeds of the issue will be utilised in repayment of temporary advances obtained for providing plant and for further extensions.

The Brush Electrical Engineering Co., Ltd., is again omitting to pay a dividend on the ordinary capital. The last ordinary distribution was 5 per cent. in respect of 1930.

The United River Plate Telephone Co. proposes to pay a final ordinary dividend of 1 per cent., making 4 per cent., less tax (same).

New Companies

South Western Electrical Engineering Co., Ltd.—Private company. Registered July 5th. Capital £500. Objects: To carry on the business of electrical engineers and contractors, manufacturers of and dealers in dynamos, motors, armatures, magnetos, batteries, insulating materials, etc. Directors: G. H. Lomas and L. L. Lomas, both of " Milestones," Hillcrest Gardens, Hinchley Wood, Esher, Surrey. Registered office: 201, Richmond Road, Twickenham, Mddx.

D. Stewart & Co., Ltd.—Private company. Registered in Edinburgh July 10th. Capital £500. Objects: To carry on the business of electricians, electrical engineers and contractors, etc. Directors: D. Stewart, 150, Chirnside Road, Hillington, Glasgow, S.W.2; M. Cowan, 54, Union Street, Glasgow, C.1, and G. Wallace, " Benone," Bishopbriggs, Glasgow. Registered office: 940, Springfield Road, Glasgow, E.1.

Wico British Electric Co., Ltd.—Private company. Registered July 8th. Capital £2,000. Objects: To carry on the business of manufacturers of and dealers in magnetos, dynamos, motors, armatures, batteries, transformers, stoves, cookers, electrical plant and supplies of all kinds, etc. Subscribers: H. J. Fellows, 13, Brampton Grove, Kenton, Middlesex, and A. J. Wildet, 24, Elm Avenue, Oxhey, Watford. Solicitors: Denton Hall & Burgin, 3, Grays Inn Place, W.C.1.

Companies' Returns

Statements of Capital

The Rheostatic Co., Ltd.—Capital £120,000 in 100,000 preference shares of 10s. each and 350,000 ordinary shares of 4s. each. Return dated February 25th, 1941. All shares taken up. £25,100 paid. £94,900 considered as paid. Mortgages and charges: Nil.

(*Continued on page* 864)

STOCKS AND SHARES

TUESDAY EVENING.

STOCK Exchange markets have been going rather more slowly, in the matter of business and of prices, than they were doing earlier in the month. Satisfaction is expressed at the manner in which the Russo-German news is developing in favour of the Allies, but it failed to bring in fresh buyers; on the other hand, it served to keep sellers out of the markets. Prices, it will be noticed by reference to the tables, are steady; the proportion of rises to falls is about seven to one.

Home Railway Year

On Friday in this week, July 25th, when the Home Railway companies declare their interim dividends for the first half of the current year, the markets for the stocks will become the centre of lively interest. For once in a way, Home Railways are very much to the fore in the mind of the investor and the speculator. Substantial rises in price have taken place during the past few weeks, and although the improvement was checked by a feeling of caution which made itself felt a few days back, Home Railway stocks are now standing well above the lowest reached during the current year. The interim dividends are expected to be on about the same lines as those of a year ago, when prices stood, however, very differently from those of to-day. A brief table of comparison may be of service, as well as of interest:—

Stock	July 22nd, 1940	Now	Rise
London Transport "A" ..	113	114¼	1¼
do. "C" ..	30	37	7
Southern preferred	45	54½	9½
do. preference ..	75	98½	23½
Metropolitan assented	40	51	11

The prices at this time last year were just beginning to rally from the flatness which followed upon the capitulation of France a few weeks earlier.

New Cawnpore Electric Issue

The Cawnpore Electric Supply Co. is about to increase its issued ordinary capital by £118,500. The ordinary shares, it will be noticed from our price lists, are quoted at about 28s. 9d. Announcement of the new issue naturally arouses a query from those who know that new issues in stocks and shares are banned under the present war regulations. Why is Cawnpore Electric allowed, it may be asked, to issue this new capital?

Authentic report states that when the Cawnpore Electric Company approached the Treasury in the first place for permission to make this new issue, the Treasury refused its consent, and suggested that the company should apply to India for the money. India however, was by no means willing to supply the capital required. Report goes on to say that the Cawnpore Electric thereupon returned to the British Treasury, pointing out that the new money was required for what was practically war work, and that, after all, the amount in question was a bagatelle in these days when finance thinks in millions instead of thousands of pounds. The Treasury, moved by these considerations, withdrew its ban and consented to the new issue being made. It is understood that the shares were placed at 25s. or thereabouts. They will carry no dividend until next January and they are offered in the market at 28s. free of stamp.

Llanelly Electric

The fortunate proprietors in the Llanelly Electric Co., who were given the right to subscribe to the new ordinary and preference shares at 43s. for the two, can now take a useful profit, if they care to part from the shares to which their option entitled them. On the new ordinary there is practically no premium over the issued price, but the 6 per cent. preference, offered at 3s. premium, can be sold at 6s. premium. The latter would seem to be a sufficiently high price for shares of this character, though it may be doubted whether the subscribers at 23s. for the fully-paid shares, will be likely to realise their investment in what is a first-rate security.

General Electric

The General Electric dividend and bonus, making in all 17½ per cent. for the year, came as a disappointment to most people, expectation having looked for maintenance of the previously-paid 20 per cent. The immediate effect upon the price was to reduce it from 84s. to 77s., but the fall brought in support up to 80s., at which the price shows a decline of 3s. 9d. on the week. The yield is 4⅛ per cent. without making allowance for accrued dividend. The figures are good.

Manufacturing & Equipment

Electric Construction shares are unchanged at 32s. 6d. The company was quoted here a fortnight ago as affording a striking example of the manner in which taxation eats into increased profits. The net profit, before tax, of £92,264, showed an increase of £35,000 over the comparable figure of the previous year, but income-tax and E.P.T. ran away with the increase in the profits and shareholders received the usual 10 per cent. dividend.

Ericsson Telephone shares are up ¼ at 37s. 6d. Enfield Cable hardened to 48s. 9d.; the interim dividend of 6¼ per cent.—the same as that of a year ago—was as expected. British Insulated Cables improved to 87s. 6d., Crabtrees to 27s. 6d., and Falk Stadelmann ordinary rose to 17s. 6d. Siemens put on half-a-crown with a rise to 23s. 9d., the liberal yield offered by the shares, on the basis of the 7½ per cent. dividend now being paid, attracting investment attention. Walsall Conduits are again 1/16 up at 31s. 3d. on Birmingham support. Brush ordinary remain at 3s. 9d.; these shares still go dividendless. Speculation has by no means finished with Electric and Musical Industries, and once again the price shows a gain at 12s. 9d. Tilling shares are better at 45s. British Electric Traction deferred is 10 points up, at 845.

Nigerian Electric

The Nigerian Electricity Supply Corporation, in declaring a second interim dividend of 4 per cent. in respect of the year ended February last, brings the distribution for that year up to 8 per cent. The first interim of 4 per cent. was paid last November. Shareholders received nothing in respect of the year ended February, 1940. In the previous February, a dividend of 3½ per cent. was paid, comparing with 7½ per cent. in each of the two previous years. The company started, it may be remembered, with an initial 3 per cent. for 1933–34. In 1939, a capital bonus of 10 per cent. was distributed. Delay in the receipt of the financial accounts is due to enemy action. Presumably the 8 per cent., of which the second moiety is now declared, will represent the dividend for the year ended last February. A few thousand shares are on offer in the market at 18s. 6d., giving at that price a return of £8 13s. 0d. per cent. on the basis of the 8 per cent. dividend mentioned above.

Globe Telegraphs

The Globe Telegraph & Trust has declared a dividend making 6 per cent. for the year, plus a bonus of 2½ per cent., both free of tax. This is ¼ per cent. less than the dividend and bonus of a year ago. The bonus is paid from the profits of the sale of the Globe Telegraph & Trust holding of 4 per cent. funded income stock issued by Cable & Wireless (Holding). When the fund from which these sales are taken is finished, the bonus will, presumably, also come to an end. It is understood that this reserve account is nearly exhausted, and the question now remains, what dividend can Globe Telegraph and Trust be expected to pay on its ordinary shares? Something more than 6 per cent. is the general expectation, though how much more it is impossible to estimate.

Telephone Manufacturing

The Telephone Manufacturing Co. dates back to 1920, but in 1929 Telephone Rentals, Ltd., was formed in order to deal with the separate interests indicated by the title. The Telephone Manufacturing Co. report shows a substantial increase in gross revenue and net profits, but, as with so many other companies, the extra earnings are taken by taxation. The company has paid a 9 per cent. annual dividend for the past five years. Its financial position is sound and the balance-sheet implies expanding activities. The price of the 5s. shares is 7s. 6d. ex dividend, returning at that figure 6 per cent. on the money, which although hardly a liberal yield, must be considered quite a useful return in view of the difficulty that prevails nowadays of obtaining 6 per cent. from a sound industrial investment.

Indian Tax-Free Shares

Two companies which have paid their dividends free of tax for some time past, are the Calcutta Electric Supply and the Madras Electric Supply, the ordinary shares in which are offered at 36s. and 23s. 6d. respectively. The Calcutta Electric Supply Co. paid 7 per cent. tax-free last year, giving a return at the price mentioned of £3 17s. 9d. per cent. net, equal to £7 15s. 6d. at the present 10s. in the £ tax. The Madras Electric Supply Co. paid 6 per cent. tax-free last year, and at this rate the yield at 23s. 6d. is £5 2s. 0d. per cent. net, equal to £10 4s. 0d. per cent. gross. Dividends on the Madras shares are payable in November and June; on the Calcutta ordinary in November and May. It is hardly necessary to add that the dividends are liable to variation.

Post-War Investments

Packets of shares in the Metropolitan Railway Surplus Lands Co. were bought, when the price stood in the neighbourhood of 8s. to 10s. for the 10s. shares, by insurance and other companies which could afford to disregard immediate income and to look for future reward in the shape of capital appreciation. Since then, however, the price has steadily declined, until to-day it stands at 4s. 6d., at which a few thousand shares are on offer. The company works in conjunction with the Metropolitan Railway and for several years dividends of 3⅛ per cent. were paid on Surplus Lands shares. Last year, the dividend dropped to 1 per cent., so that at the present price of 4s. 6d. the yield comes to a negligible 2½ per cent. The shares are of that order which attract speculative investment which ignores income and yield. One of these days, the assets and the freehold properties in which the Metropolitan Surplus Lands Co. is interested will increase in value, it may be assumed, to an enormous extent, and the shares are of that class which can be regarded as hostages given to a return of prosperity after the war.

ELECTRICAL COMPANIES' SHARES

Prices, Dividends and Yields

Company	1941 High-est	1941 Low-est	Dividend Pre-vious	Dividend Last	Middle Price July 21	Rise or Fall	Yield £ s. d.
Home Electricity Companies							
Bournemouth and Poole	48/6	45/–	15	12½	47/6	..	5 5 3
British Power and Light	27/9	23/–	7	6	25/–	+6d.	4 16 0
City of London	22/6	20/–	7½	7	23/9	+⅛	5 18 0
Clyde Valley	36/6	33/6	8	8	35/9	..	4 9 6
County of London	34/6	30/–	10½	8	32/6	..	4 18 6
Edmundson's:							
7% Pref.	31/–	25/6	7	7	30/9	..	4 11 1
Ord.	26/–	23/6	6	6	26/–	..	4 12 4
Elec. Dis. Yorkshire	39/–	36/–	9	9	39/6	+9d.	4 11 2
Elec. Fin. and Securities	42/6	39/–	12½	12½	42/6	..	5 17 8
Elec. Supply Corporation	39/6	36/–	11½	10	40/–	+6d.	5 0 0
Isle of Thanet	8/–	6/–	2	Nil	8/–	..	—
Lancs Light and Power	32/–	28/6	7½	7½	32/–	..	4 13 9
Llanelly Elec.	21/–	19/6	5½	5½	20/–	..	5 10 0
Lond. Assoc. Electric	17/6	12/6	5½	4½	17/6	+6d.	5 2 10
London Electric	23/6	21/3	7	7	22/6	..	6 4 5
London Power Deb. Red.	105½	102	5	5	103½	..	4 16 7
Metropolitan	34/6	31/–	10	8	32/6	..	4 18 6
Midland Counties	36/6	32/9	8	8	36/3	..	4 8 5
Mid. Elec. Power	35/–	33/3	9	9	35/–	..	5 2 10
Newcastle Elec.	26/3	24/6	7	7	25/–	..	5 12 0
North Eastern Elec.:							
Ordinary	29/–	25/6	7	7	28/3	..	4 19 1
7% Pref.	32/6	29/–	7	7	32/6	..	4 6 2
Northampton	2⅛	39/6	10	10	41/3	..	4 17 0
Notting Hill 6% Pref. (£10)	9	8	6	6	8½	..	—
Northmet Power:							
Ordinary	34/6	28/6	10	7	31/3	..	4 9 7
6% Pref.	29/6	27/3	6	6	29/6	..	4 1 4
Richmond Elec.	20/–	18/–	6	6	20/–	..	6 0 0
Scottish Power	36/6	33/–	8	8	36/3	..	4 8 5
Southern Areas	16/6	14/6	5	5	16/3	..	6 3 0
South London	20/–	19/3	7	7	22/6	+½	6 4 5
West Devon	21/6	20/9	5	5	21/3	..	4 14 1
West Glos.	18/3	17/3	4½	4½	18/3	..	4 18 8
Yorkshire Elec.	38/3	34/6	8	8	38/3	..	4 4 0
Overseas Electricity Companies							
Atlas Elec.	2/6	1/6	Nil	Nil	2/6	..	—
Calcutta Elec.	37/3	33/–	8*	7*	35/6	..	3 19 0
Cawnpore Elec.	30/–	26/–	10	10	28/9	..	7 5 9
East African Power	25/6	21/6	7	7	25/–	..	5 12 0
Jerusalem Elec.	22/6	18/6	7	7	18/9	..	7 9 4
Kalgoorlie (10/–)	12/6	11/–	7½	7½	12/6	..	6 0 0
Madras Elec.	25/3	23/6	8*	6*	23/3	..	—
Montreal Power	31	24	1½	1½	24½	..	6 2 5
Palestine Elec. "A"	20/6	14/–	Nil	Nil	18/3	+2/–	—
Perak Hydro-electric	18/3	16/3	2½	6	17/6	..	6 17 2
Shawinigan Power	18½	14	83cts.	90cts.	15½	..	—
Tokyo Elec. 6%	40½	33	6	6	35½	..	16 18 0
Victoria Falls Power	76/6	69/6	15	15	76/3	..	3 18 9
Whitehall Investment Pref.	14/9	8/3	7½	7½	12/6	+6d.	12 0 0
Public Boards							
Central Electricity:							
1950–70	112	108	5	5	111	+½	4 10 1
1955–75	113½	109½	5	5	113	..	4 8 6
1951–73	108	105½	4½	4½	108	+1	4 3 4
1963–93	101	94	3½	3½	100	..	3 10 0
1974–94	94	87¾	3½	3½	94	..	3 9 2
London Elec. Trans. Ltd.	94	91½	2½	2½	94	..	2 13 2
London & Home Counties							
1955–75	108	106	4½	4½	106½	..	4 4 6
Lond. Passenger Transport:							
A	120	109	4½	4½	114½	..	3 18 4
B	114	102½	5	5	109½	..	4 11 4
C	38	29	1½	3	37	..	8 2 2
West Midlands Joint Elec.							
1948–68	108½	103	5	5	108½	..	4 12 0
Telegraph and Telephone							
Anglo-Am. Tel:							
Pref.	106	99	6	6	105½	..	5 13 9
Def.	24½	21	1½	1½	24½	..	6 2 5
Anglo-Portuguese	17/6	12/6	8	8	15/–	..	10 13 4
Cable & Wireless:							
5½% Pref.	102	93	4½	5½	102	..	5 7 10
Ord.	68	52½	4	4	60½	−1½	6 12 4
Canadian Marconi $1	5/6	4/–	Nil	4cts.	5/6	..	3 4 0
Globe Tel. & Tel.:							
Ord.	29/–	26/–	8½*	8¼*	27/6	..	—
Pref.	28/–	25/–	6	6	27/6	..	4 7 3
Great Northern Tel. (£10)	14	10½	20	20	12½	..	—
Inter. Tel. & Tel.	3½	2½	Nil	Nil	3	..	—
Marconi-Marine	25/–	19/9	7½	7½	25/–	..	6 3 0
Oriental Telephone Ord.	57/6	47/–	11¼*	16	2⅞	..	5 11 4
Telephone Props.	11/6	11/–	6	6	11/3	..	10 13 4
Telephone Rental (5/–)	7/9	6/9	10	10	7/3	..	6 18 0

Company	1941 High-est	1941 Low-est	Dividend Pre-vious	Dividend Last	Middle Price July 21	Rise or Fall	Yield £ s. d.
Traction and Transport							
Anglo. Arg. Trams:							
First Pref. (£5)	2/3	1/–	Nil	Nil	2/–	..	—
4% Inc.	8½	4	Nil	Nil	6	..	—
British Electric Traction:							
Def. Ord.	860	740	45	45	845	+10	5 6 6
Pref. Ord.	180	150	8	8	160	..	5 0 0
Bristol Trams	40/–	36/–	8*	8	36/3	..	4 8 5
Brazil Traction	9½	6½	$1	50c.	8¾	..	—
Calcutta Trams	19/9	18/–	8	5½	18/–	..	6 2 3
Cape Elec. Trams	17/6	16/6	5	5	17/–	..	5 17 4
Lancs Transport	40/–	36/–	10	10	40/–	..	5 0 0
Mexican Light:							
1st Bonds	40	34½	5	5	40	..	—
Rio 5% Bonds	85½	82½	5	5	85	..	5 17 8
Southern Rly.:							
5% Prefd.	55	43½	5	5	54½	..	9 3 6
5% Pref.	99	77½	5	5	98	+½	5 1 7
T. Tilling	45/–	34/6	10	10	45/–	+⅛	4 9 0
Tilling & B.A.	52/–	45/6	8*	7*	50/–	..	2 16 0
West Riding	38/–	34/–	10	10	38/–	..	5 5 4
Equipment and Manufacturing							
Aron Electricity Ord.	18/6	16/–	15	Nil	18/–	..	—
Assoc. Elec.:							
Ord.	42/6	38/3	10	10	42/6	..	4 14 3
Pref.	36/–	33/3	8	8	35/–	..	4 11 5
Automatic Telephone & El.	47/3	32/–	12½	12½	45/–	..	5 11 1
Babcock & Wilcox	45/–	39/–	11	11	44/6	+9d.	4 18 10
British Aluminium	44/6	39/–	12½	10	44/6	..	4 10 0
British Insulated Ord.	88/3	78/9	20	20	87/6	+⅛	4 11 4
British Thermostat (5/–)	12/6	10/6	18½	18½	12/6xd.	..	7 8 0
British Vacuum Cleaner (5/–)	6/3	6/–	40	12½	6/3	..	10 0 0
Brush Ord.	4/3	3/6	Nil	Nil	3/9	..	—
Callender's	65/6	58/6	15	15	65/–	..	4 12 4
Chloride Elec. Storage	63/6	60/–	15	15	62/6	..	4 15 10
Consolidated Signal	65/–	60/–	17	17	62/6	..	5 8 7
Crabtree (10/–)	27/6	21/3	17½	17½	27/6	+⅛	6 7 4
Crompton Parkinson:							
Ord. (5/–)	19/6	17/9	30	20	19/6	..	5 2 8
E. K. Cole (5/–)	7/6	2/9	10	Nil	7/–	..	—
Elec. & Musical Industries (10/–)	13/–	7/3	5	Nil	12/9	+6d.	—
Electric Construction	33/–	25/–	10½	10	32/6	..	6 3 0
Enfield Cable Ord.	51/–	45/–	16½	12½	48/9	+⅛	5 2 6
Electrical Switchgear (10/–)	22/6	20/–	16	10	20/–	..	5 0 0
English Electric	35/–	29/–	10	10	35/–	..	5 14 2
Ensign Lamps (5/–)	16/3	15/–	25	25	16/3	..	7 13 10
Ericsson Tel. (5/–)	38/–	35/–	25*	22*	37/6	+½	2 18 8
Ever Ready (5/–)	28/6	25/–	40	40	28/3	+3d.	7 1 7
Falk Stadelmann	16/9	13/9	6	7	15/9	..	8 17 10
Ferranti Pref.	26/6	23/6	7	7	26/3	..	5 6 10
G.E.C.							
Pref.	33/–	30/6	6½	6½	32/6	..	4 0 0
Ord.	84/–	77/–	20	17½	80/–	−⅝	4 7 6
Greenwood & Batley	21/–	18/6	15	13	20/–	..	13 0 0
Hall Telephone (10/–)	14/–	10/–	15	10	13/9	..	7 5 6
Henley's (5/–)	21/6	19/6	20	20	21/3	..	4 14 1
4½% Pref.	21/6	20/–	4½	4½	21/3	..	4 4 8
Hopkinsons	47/6	37/6	15	15	47/3+⅛	..	6 6 4
India-Rubber Pref.	21/6	19/6	5½	5½	21/3	..	5 3 6
Intl. Combustion	100/–	81/3	32½	30	100/–	..	6 0 0
J. Lucas	59/–	50/6	15	15	58/9	..	5 2 0
Johnson & Phillips	48/9	43/–	15	15	48/9	..	6 3 0
Lancashire Dynamo	53/6	50/–	20	20	52/6	..	7 12 5
Laurence, Scott (5/–)	10/6	7/6	15	15	10/6	..	7 2 10
London Elec. Wire	25/6	20/–	7½	7½	22/6	..	6 13 4
Mather & Platt	40/–	32/–	13½	10	40/–	..	5 0 0
Metropolitan Elec. Cable Pf.	22/–	21/3	5½	5½	21/3	..	5 3 6
Murex	84/6	75/–	20	20	83/9	..	4 15 8
Pye Deferred (5/–)	14/–	10/9	25	25	13/9	..	9 1 10
Revo (10/–)	25/–	18/9	5	20	23/9	−⅛	8 8 5
Reyrolle	55/–	47/9	12½	12½	55/–	..	4 10 3
Siemens Ord.	24/–	17/–	7½	7½	23/9	+½	6 6 4
Strand Elec. (5/–)	2/–	1/–	4	2	2/–	..	5 0 0
S. Smith (1/–)	7/9	5/9	37½	50	6/3	..	8 0 0
Switchgear & Cowans (5/–)	9/–	7/3	10	15	8/9	..	8 11 6
Telegraph Condenser (10/–)	12/6	7/–	Nil	5	10/–	..	5 0 0
Telegraph Construction	40/–	34/6	10	10	40/–	..	5 0 0
Telephone Mfg. (5/–)	7/6	6/9	9	9	7/3	..	6 4 2
Tube Investments	95/–	89/–	23¾	23¾	94/6	+9d.	5 0 0
Vactric (5/–)	2/3	2/–	4	Nil	2/–	..	—
Vickers (10/–)	16/–	14/–	10	10	15/9	..	6 7 0
Ward & Goldstone (5/–)	19/9	12/6	20	20	16/6	..	5 19 9
Westinghouse Brake	42/6	39/6	17½	10	42/–	..	4 15 1
Walsall Conduits (4/–)	31/6	24/6	55	55	31/3	+⅛	7 0 9
West Allen (5/–)	4/3	3/6	7½	7½	3/9	..	10 0 0

* Dividends are paid free of Income Tax.

Financial Section (*Concluded from page* 861)

Electric Power & Communications Trust, Ltd.—Capital £100,000 in £1 shares. Return dated April 3rd, 1941. 20,000 shares taken up. £9,314 paid. £10,686 considered as paid. Mortgages and charges: Nil.

Battery Service (Yorks), Ltd.—Capital £500 in £1 shares. Return dated December 31st, 1940 (filed April 9th, 1941). All shares taken up. £500 paid. Mortgages and charges: Nil.

"Diamond H." Switches, Ltd.—Capital £3,000 in £1 shares. Return dated June 6th, 1941. 2,000 shares taken up. £2,000 paid. Mortgages and charges: Nil.

Rowlands Electrical Accessories, Ltd.—Capital £5,000 in 3,000 preference and 2,000 ordinary shares of £1 each. Return dated January 13th, 1941. 2,019 preference and 1,161 ordinary shares taken up. £3,180 paid. Mortgages and charges: £4,515.

Armature & Electrical Repairs, Ltd.—Capital £4,000 in £1 shares. Return dated May 31st, 1941. 2,000 shares taken up. £2,000 considered as paid. Mortgages and charges: Nil.

Mortgages and Charges

Holden & Hunt, Ltd.—Debenture, charged on freehold property in Cox's Lane, Old Hill, and the company's undertaking and other property, present and future, including uncalled capital, dated June 12th, 1941, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd.

Second debenture, charged on the company's undertaking and property, including uncalled capital, dated June 14th, 1941, to secure £6,300. Holders: South Birmingham Permanent Money Society, Ltd.

Kelvin-Norton Electric Co., Ltd.—Equitable charge, on moneys due or to become due under a certain order, dated June 2nd, 1941, to secure all moneys due or to become due from the company to the Midland Bank, Ltd.

Underwood (Electric), Ltd.—Assignment of all moneys due or to become due under certain contracts, dated July 2nd, 1941, to secure all moneys due or to become due to Martins Bank, Ltd., not exceeding £1,500.

Liquidations

John Collier & Co. (Electrical Engineers), Ltd.—Meetings pursuant to section 245 of the Companies Act, 1929, on August 22nd, at 7, Norfolk Street, Manchester, to receive an account of the winding-up by the liquidator, Mr. C. M. Skinner.

Bankruptcies

A. J. Harding, electrical engineer, 50-51, Broad Street and West Street, Hereford.—Bankrupt discharged, subject to his consent to judgment being entered against him by the Official Receiver for £250 and £1 10s. costs. (Consent given and judgment entered.)

CONTRACT INFORMATION

Tenders Invited and Accepted. Schemes Promising Electrical Work.

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Aberdeen.—July 28th. Corporation. Three months' supply of various articles, including electrical fittings. Schedule from City Engineer's Office, Town House.

Australia.—SYDNEY (N.S.W.).—November 13th. County Council. 33-kV switchgear and associated equipment for the Pyrmont power station.

Belfast.—August 1st. Electricity Department. 6.6 kV armourclad switchgear (specification No. W.362). Specification, with form of tender from the city electrical engineer and general manager, East Bridge Street.

Darlington.—Town Council. August 1st. Lighting of communal shelters. (See this issue.)

Kettering.—August 6th. Electricity Department. Oil-immersed transformers. (July 11th.)

New Zealand.—POSTS AND TELEGRAPH DEPARTMENT.—August 13th. Switchboard cords. August 25th. Condensers and three-conductor cords. August 29th. Cadmium-copper binders and tapes. September 1st. Tumbler switches and fuses. September 2nd. 60 tons of copper wire. September 5th. 60 miles of tinned copper wire.

AUCKLAND HARBOUR BOARD.—September 30th. Ten 5-ton electric cranes.

Northern Ireland.—BELFAST.—August 1st.—Electricity Committee. 6.6-kV armourclad switchgear. (See this issue.)

Plymouth.—August 13th. Electricity Supply Department. Valve for circulating water system, and rotary boiler feed pump. (July 18th.)

Orders Placed

Barrow - in - Furness.—Electricity Committee. Accepted. Switchboard (£1,210 plus £77 for erection).—British Thomson-Houston Co. Fire protection at switch-house (£328).—Foamite. Boiler feed water treatment plant (£564).—Neckar Water Softener Co.

Exeter.—Electricity Committee. Accepted. Transformers (£1,118).—Bonar Long & Co.

India. — BOMBAY. — Municipal Council. Accepted. Hospital electrical installation (Rs. 20,618).—Sterling Electric Works. Three electric pumping sets (Rs. 1,875).—William Jacks & Co.

London.—Metropolitan Water Board. Accepted. Electrical equipment for underwater lighting in primary filters at Hampton works (£139).—G.E.C. Installation of resistances and switches for re-charging batteries on ten generating units (£50).—Igranic Electric Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Barrow-in-Furness.—Workshop, Ironworks Road; Little & Angus.

Bedford. — Restaurant, Gwyn Street; borough engineer.

Belford (Northumberland).—Hostel for 50 agricultural workers; R. Carse & Son, builders, Amble.

Blyth.—British Restaurants, and completion of flats in Newsham Road for the T.C.; T. Wilson, borough engineer.

Bristol.—A.R.P. premises (£19,000); city architect.

Collyhurst. — Works extensions; A. McDonald, architect, 70, Newport Road, Chorlton-cum-Hardy, Manchester.

Co. Durham.—Feeding and sleeping centres for County Council (£40,000); F. Willey, 34, Old Elvet, Durham.

Coventry.—Re-wiring Foleshill Baths for electrical equipment, for T.C.; D. E. E. Gibson, city architect, 1a, Warwick Row.

Dewsbury.—Electric heaters for sirens, for T.C. (£74); M. H. Forward, borough architect, Town Hall.

Gateshead-on-Tyne.—Bri.ish Restaurant in Redheugh Road; N. Yeaman, Back Chandos Street.

Haswell (Co. Durham).—Conversion of the Miners' Hall, Haswell, into communal feeding centre and auxiliary fire service headquarters, for Easington Rural Council; C. Clarke, surveyor, R.D.C. offices, Easington.

Houghton-le-Spring (Co. Durham).—Canteen at Houghton-le-Spring Colliery; Plans by the Colliery staff.

Kettering.—Alterations, boot and shoe works, York Road, and works at Victoria Street; secretary, Upson's, Ltd., Victoria Street.

Levenshulme.—Additions to works; W. Johnson & Sons, architects, 27, Oldham Road, Miles Platting, Manchester, 8.

London. — CAMBERWELL. — Garage, Grove Vale depot (£3,085); borough engineer.

WANDSWORTH. — Gas cleansing facilities (£5,000), for B.C.; borough engineer, Municipal Buildings.

Maghull.—Junior school (80 places), Dover Road, for Lancashire E.C.; E. H. Bampton, Ltd., builders, Aughton Park, Ormskirk, near Liverpool.

Manchester.—Restaurants (£7,400); city architect.

Shop and warehouse, Jaeger's, Ltd.; Hill, Sandy & Norris, architects, 9, Albert Square.

Reinstatement of business premises, Bridge Street; Leech & Ratcliffe, architects, 7, Cheapside, Manchester.

Newcastle-on-Tyne.—Offices and sanitary accommodation, Carliol Place, for R. B. Charlton & Co.; Exors. of J. F. Simpson, builders, Railway Banks, Manors.

Renfrewshire.—Emergency casualty hospital (480 beds), at Johnstone; county engineer, Paisley.

Romford.—Staff accommodation, Oldchurch Hospital (£4,120); Essex county architect.

Rotherham.—Garage, Wellgate; Moorhouse & Co. (Rotherham), Ltd., Wellgate.

Ryton - on - Tyne.—Community feeding centres; U.D.C. surveyor.

Sedgley.—Stores, Jews Lane; Bate Bros.

Stockton - on - Tees.—Feeding kitchens in Egglestone Terrace and Portrack Lane, and British Restaurant in Alma Street; A. S. Knolles, borough engineer.

Central kitchen at Bath Lane School, for the E.C. (£465); Thornton Construction Co., Ltd., builders, Bridge Road.

Sunderland.—Dining room and kitchen for Short Bros., Ltd.

Conversion of premises in Cliff Terrace into warehouse for J. A. Jobling, Sunderland.

Extension of premises, including offices; J. Cummings, builder and contractor, Matamba Terrace.

Canteen, for the Wearmouth Colliery Co.; manager, Wearmouth Colliery Co.

Swansea.—Additions, 28 Page Street; Swansea Co-operative Society, Ltd.

Café additions, St. Helens Road; Lovells, Ltd.

Warehouse, Workers' Hall, Killay; Swansea Press, Ltd.

Service depot, Morriston (£1,476), and Maternity Hospital, Gower; borough architect.

Swindon.—Kitchens; borough engineer.

Tenterden (Kent).—50 hostels for agricultural workers, Appledore; P. G. Banfield, clerk, Council Offices, Tenterden, Kent.

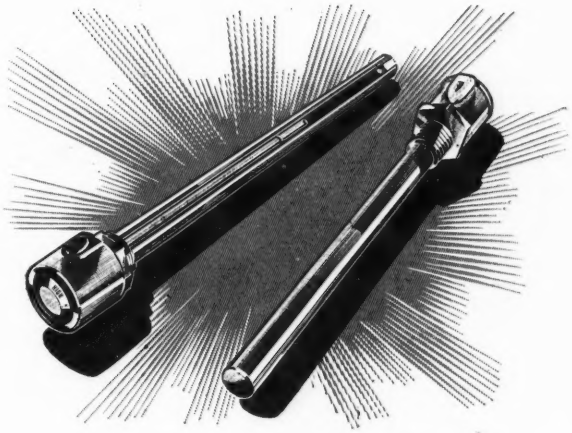
York.—Pump house, etc., at sewage works; Lansdowne Building Co.

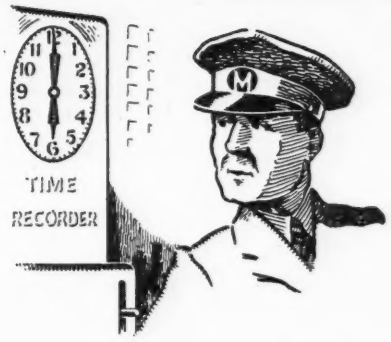
Pump house, Dean's Park; Dean and Chapter, York Minster.

Seaton Valley (Northumberland).—Communal restaurants, for U.D.C.; S. E. Burgess, surveyor, U.D.C. offices, Seaton Delaval.

Walsall.—Reconditioning houses; borough engineer.

Maintenance Men are only human





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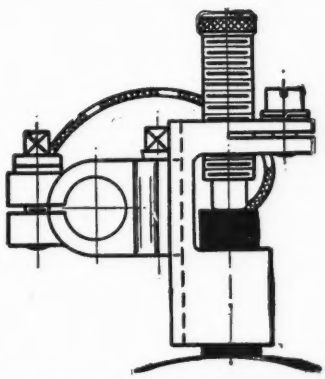

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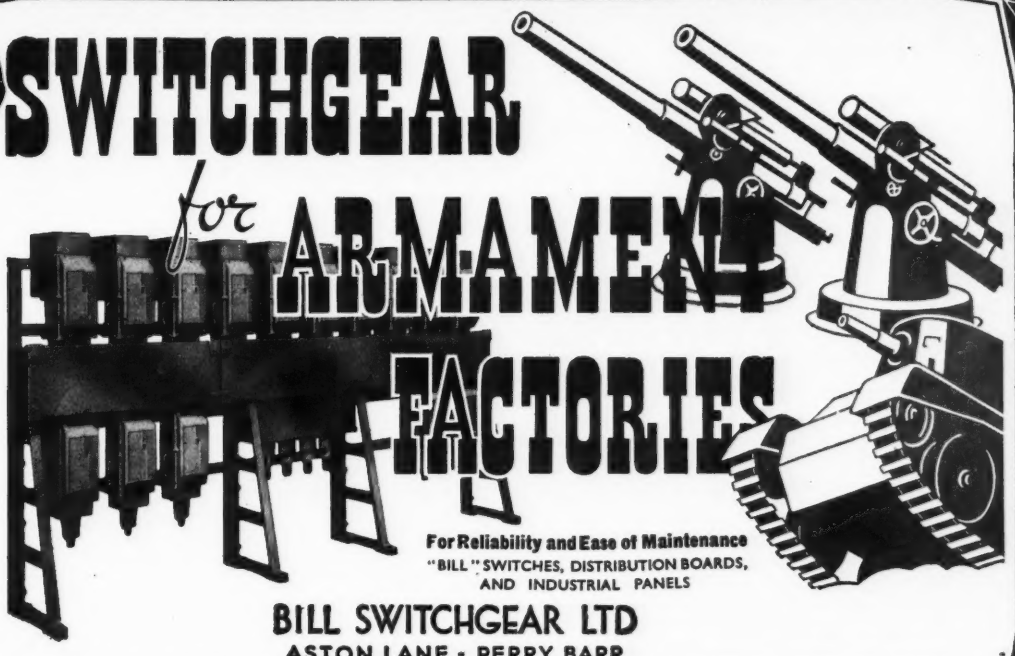

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"NEVER KNEW SUCH A '*LIGHT*'-HEARTED LOT O' BLOKES AS WE ARE SINCE THEY PUT THESE MAZDA FLUORESCENT LAMPS IN! TALK ABOUT TURNING NIGHT INTO DAY! WHY THEY TURNS WORK INTO PLAY, AS WELL!"

THE BTH LIGHT-CONDITIONING CODE

1. Regard the problem from the workers' point of view rather than from that of the casual observer
2. Eliminate glitter from the work and glitter and dazzle from the local field of view
3. Provide adequate illumination
4. Eliminate dazzle or glitter from the general surroundings
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- ★6. Take into account the purely psychological factors by promoting cheerful, comfortable and safe working conditions
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Perhaps the most important result of B T H Light-Conditioning is its effect upon the spirits of the worker. In preparing plans for the lighting of industrial premises, B T H Engineers give first place to psychological factors, because they know that the kind of lighting that ministers most to the cheerfulness, comfort and well-being of the workers will also have the best effect on production.

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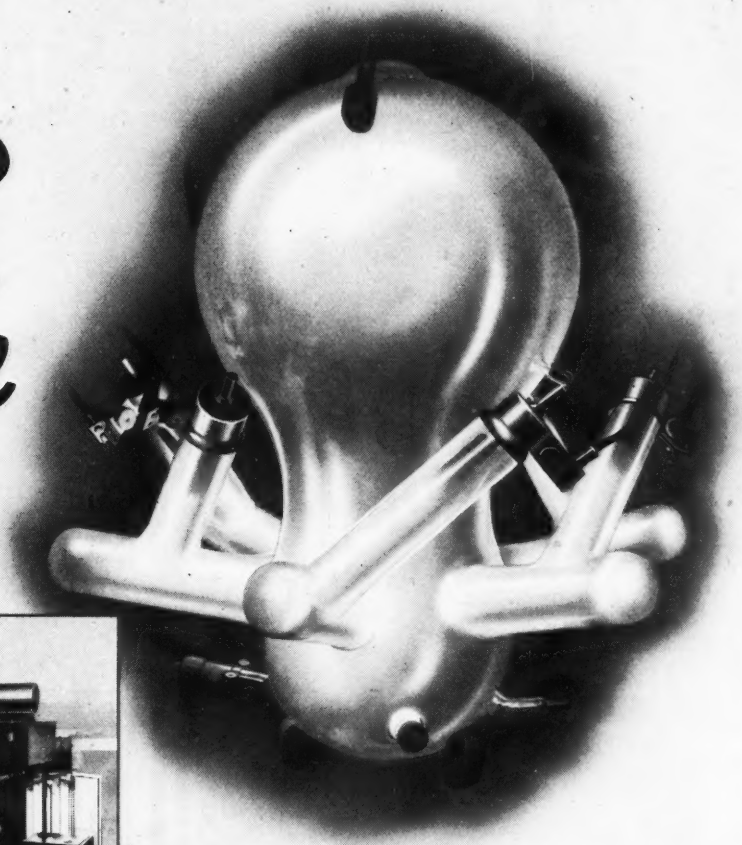

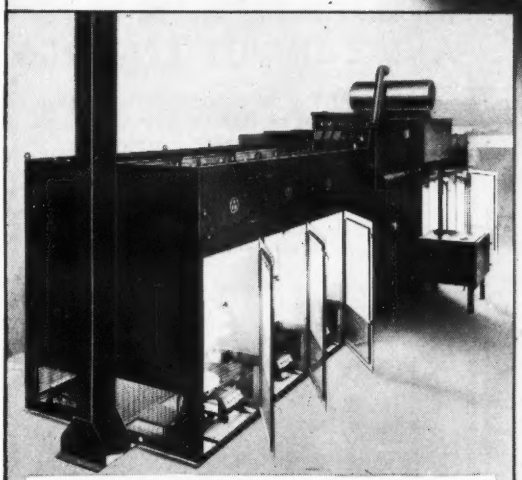

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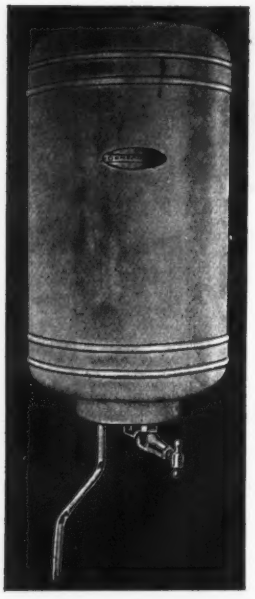

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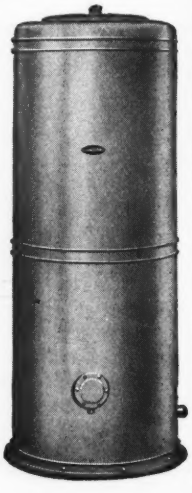

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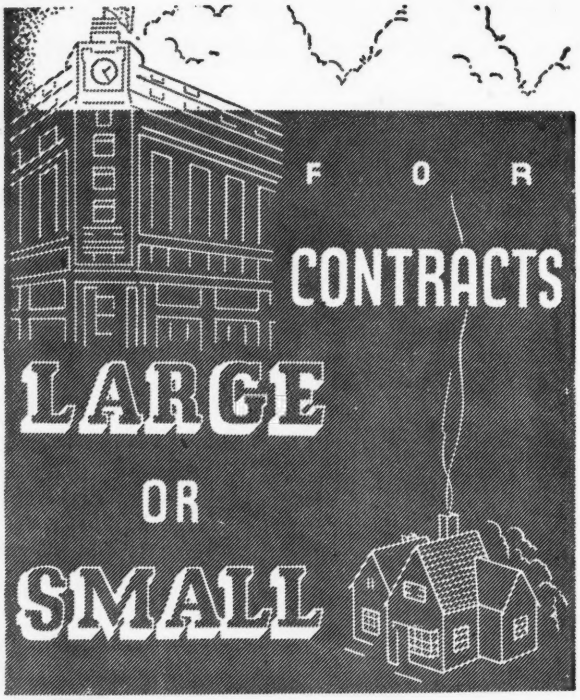

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BETTER GRINDING at lower cost

Grinding wheel efficiency can only be measured in terms of metal removed/wheel wear. This ratio, as determined by analysing numerous tests, is:—

7 : 1 on Hicycle grinders.
3 : 1 on Compressed air grinders.
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Hicycle grinders thus reduce grinding wheel costs by 50% and grinding output is proportionately increased.

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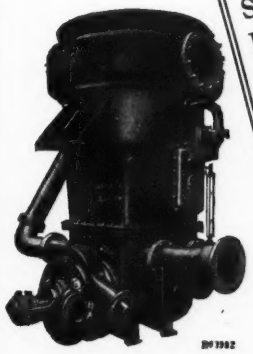
ADVT. OF THE CONSOLIDATED PNEUMATIC TOOL COMPANY LIMITED
REGISTERED OFFICES 232 DAWES ROAD LONDON · S·W·6

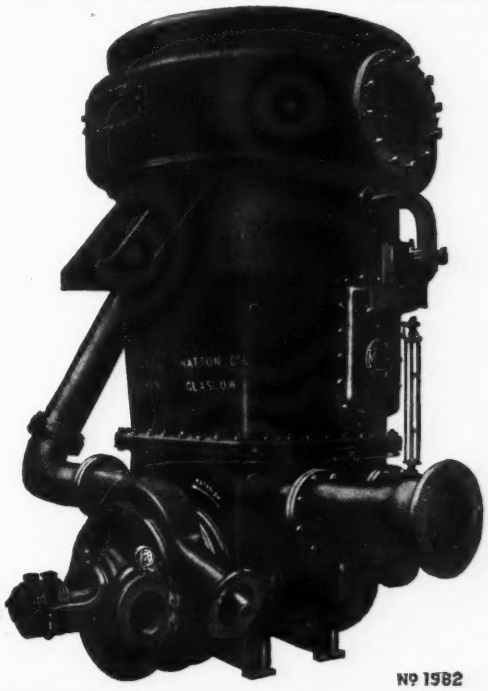
'Mirrlees'

All sizes of Plant built to the same high standard

Always specify 'Mirrlees' for

Steam Condensing Plants.
Evaporators.
De-aerators.
Feed Water Heaters.
Ejector Air Pumps,
and all Condensing Plant Auxiliaries.





No 1982

The MIRRLEES WATSON COMPANY LIMITED
ENGINEERS GLASGOW

Such a docile animal . . . until it's roused ! . . . . . but when it comes to a real fight, the apparently innocent mongoose will unhesitatingly tackle the biggest and most venomous snake—and invariably win !

Everyone in Great Britain is naturally busy at the moment helping to tackle the world's most venomous enemy, but we in the R.E.A.L. organisation look forward with confidence to the time when we can again devote our energies (in a painstaking, rather than a pains-giving manner!) to the peaceful prosperity alike of our patient customers and our impatient selves.

An advertisement of Rowlands Electrical Accessories Ltd., R.E.A.L. Works, Hockley Hill, Birmingham 13

FOR USE IN COAL MINES!

B.I. Cables are designed for use with conveyors, loaders, and other machines which require to be moved at intervals. They comply in all respects with the regulations of the Mines Department for such work.

Catalogue N.S.M. 3. gives full particulars of the three main types of **B.I.** Conveyor Cables.

B.I. Drill Cables are designed for use with portable drills on A.C. circuits and are available in two sizes and six types, and are described in catalogue N.S.M. 4.

Copies of these catalogues will be forwarded on request.

U.K. REGD TRADE MARK

B.I. CONVEYOR AND DRILL CABLES

BRITISH INSULATED CABLES LTD.

Head Office:- PRESCOT — LANCS. Tel. No: PRESCOT 6571.

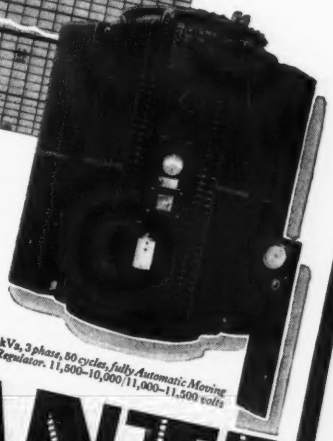
THE
STEEL
PLATE
BATTERY
NIFE
FOR ALL PURPOSES
All steel construction plates which cannot buckle, grow or shed active material ; no sulphation ; no corrosive fumes ; unharmed by overcharging, rapid discharging or short-circuiting ; light in weight ; simple to operate and long life— all these characteristics will doubtless meet your battery problem with advantage
NIFE BATTERIES
LIMITED
HUNT END WORKS · REDDITCH · WORCESTERSHIRE

UPS and DOWNS

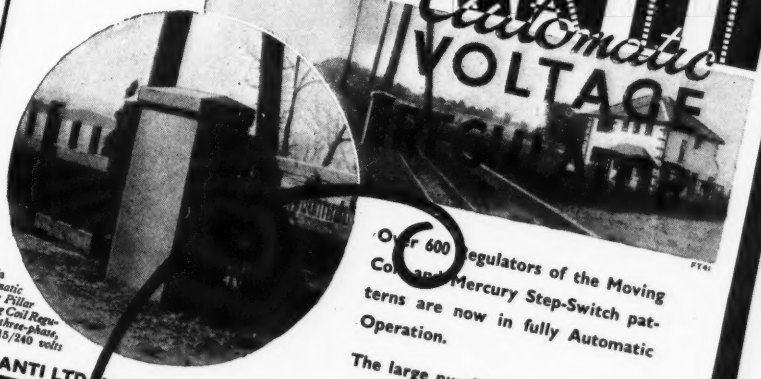
of Electricity Distribution are cured by

FERRANTI

Automatic VOLTAGE REGULATORS



7,500kVa, 3 phase, 50 cycles, fully Automatic Moving Coil Regulator. 11,500–10,000/11,000–11,500 volts



50kVa Automatic Feeder Pillar Moving Coil Regulator, three-phase, 240–215/240 volts

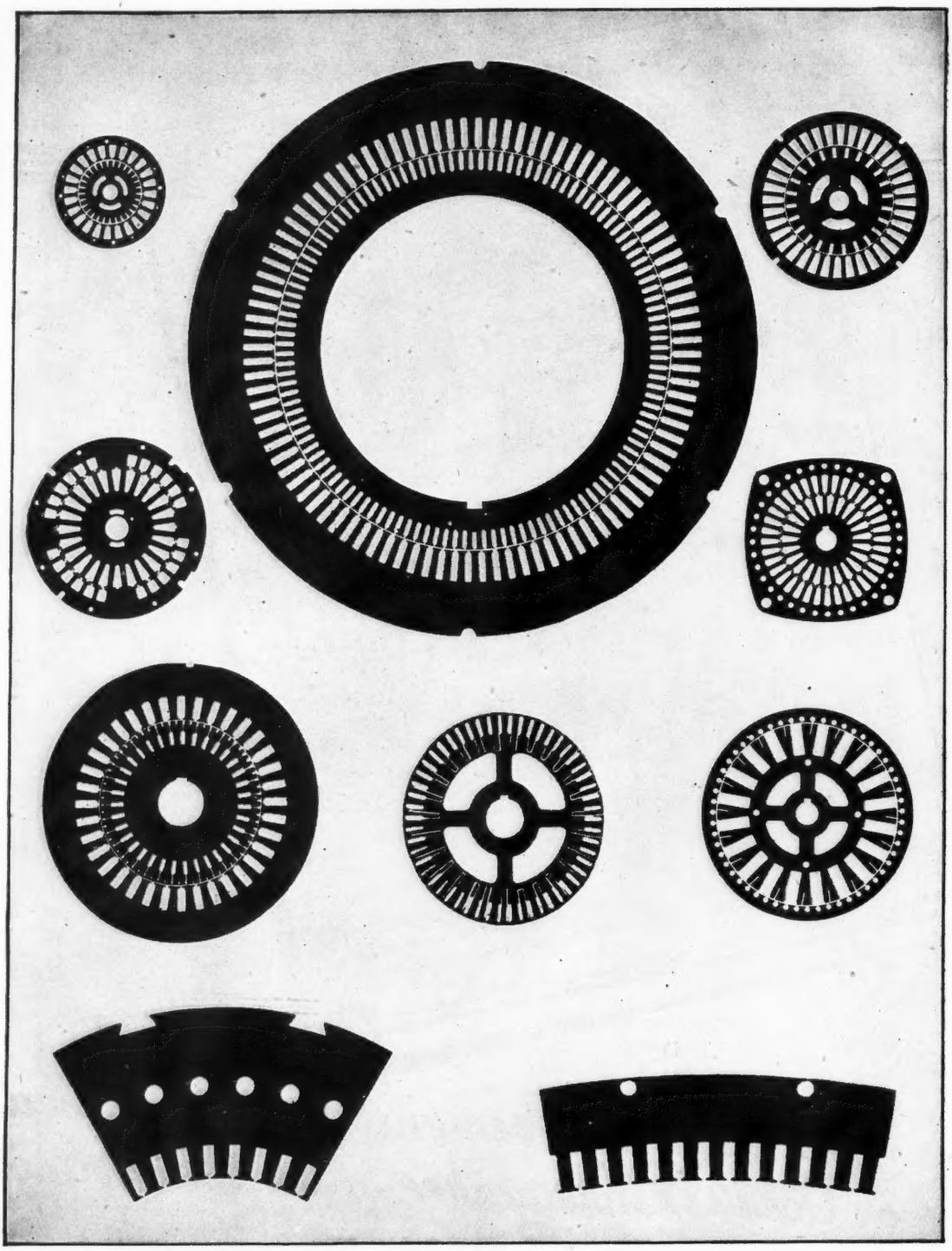
Over 600 Regulators of the Moving Coil and Mercury Step-Switch patterns are now in fully Automatic Operation.

The large number of repeat orders affords proof of dependability.

FERRANTI LTD., HOLLINWOOD, LANCS., London Offices: Bush House, Aldwych, W.C.2.

Since this advertisement first appeared in Oct. 1937 the number of Ferranti Voltage Regulators in use has been more than doubled.

Over 1,200 are now employed by Supply Authorities in Britain and abroad.

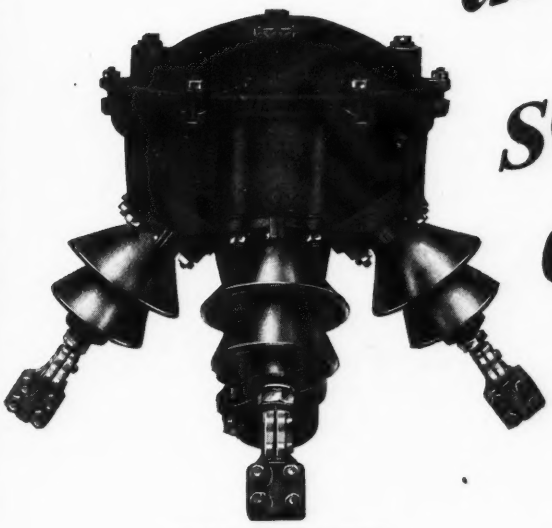


ELECTRICAL STEEL . . .
. . . SHEETS and LAMINATIONS
BRANDS: "STALLOY," "MEDIUM RESISTANCE," "SPECIAL LOHYS," "LOHYS"
JOSEPH SANKEY & SONS LTD., BILSTON
LONDON: 168 Regent Street, W.1

HENLEY TIER TYPE TERMINAL BOXES for twin, 3, 4, and 5-core cables up to 2,200 V.

These three Terminal Boxes are soundly designed and soundly made

HENLEY OUTDOOR INVERTED TYPE TERMINAL BOXES for twin and 3-core cables up to 2,200 V. and for 4 and 5-core cables up to 650 V.



HENLEY OUTDOOR INVERTED TYPE TERMINAL BOXES up to 22,000 V.

They were introduced after prolonged investigation and practical experience of actual working conditions and their reliability has been proved by the unfailing service they have given wherever they have been installed. Write for full technical details.

HENLEY

OUTDOOR TERMINAL BOXES

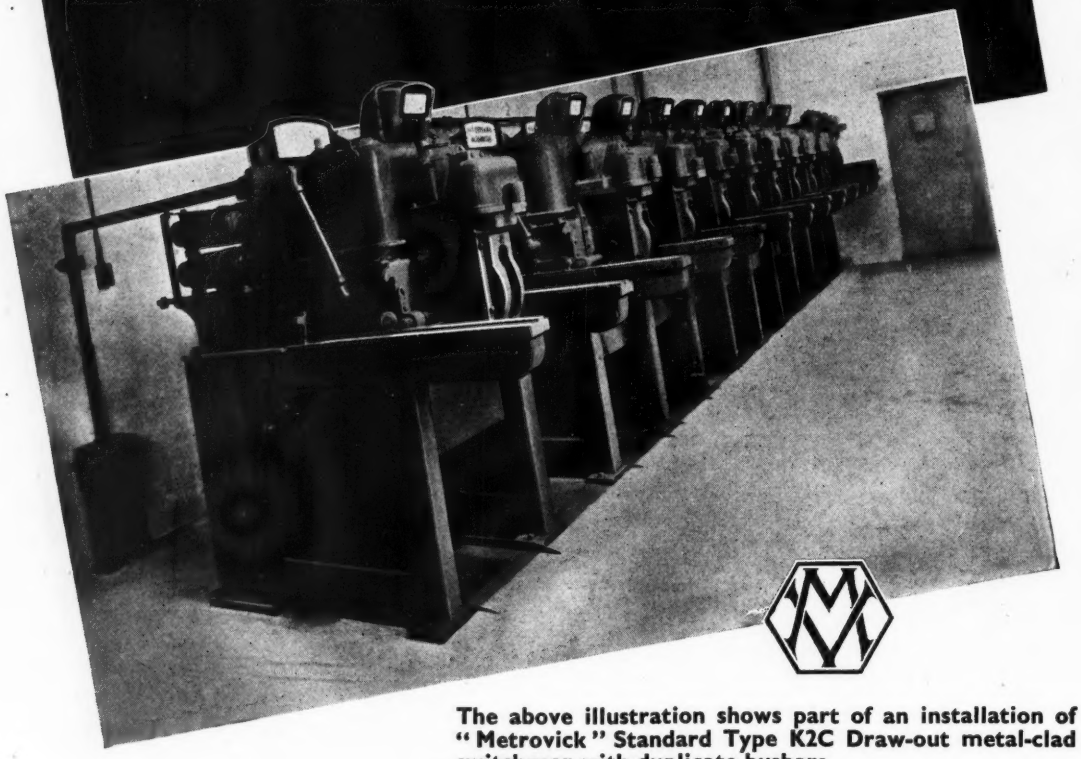
W. T. HENLEY'S TELEGRAPH WORKS CO. LTD.

MILTON COURT · WESTCOTT · DORKING · SURREY

Telephone—Dorking 3241 (10 lines) *Telegrams—Henletel Dorking*

BRANCHES AND AGENTS THROUGHOUT THE WORLD

Metal-clad SWITCHGEAR



The above illustration shows part of an installation of "Metrovick" Standard Type K2C Draw-out metal-clad switchgear with duplicate busbars.

Each oil circuit-breaker has a proved breaking capacity (BSS 116-1937) of 21,900 amperes, *i.e.*, 250 MVA at 6,600 volts.

METROPOLITAN Vickers
ELECTRICAL CO., LTD.
TRAFFORD PARK ··· MANCHESTER 17.

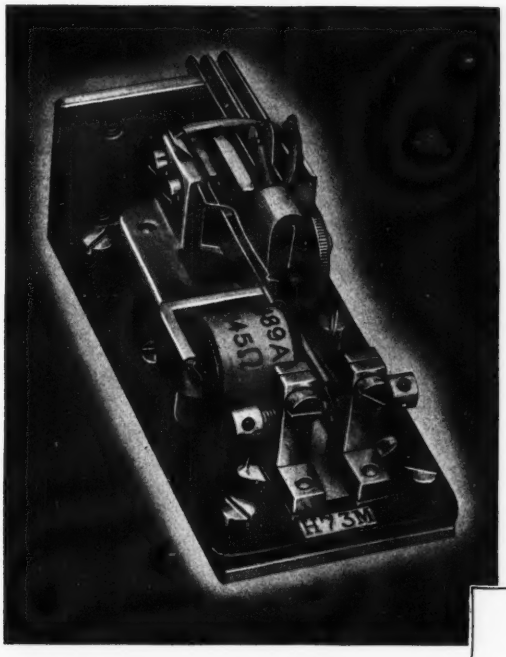
AEI

Switch to COSMOS LAMPS

F/K/001

SIEMENS

HIGH-SPEED RELAY

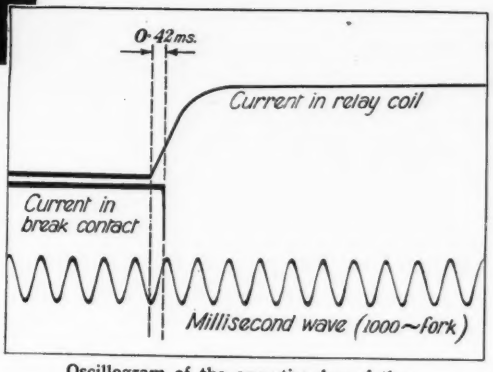


This relay was originally designed to arrest the drive of our Motor Uniselector. The time available for the testing operation with this switch is of the order of ·0005 second.

The relay with its features of :—

Robust construction—Small size and weight—Simple and easy adjustment—Extremely rapid operation and release—and Insensitivity to external mechanical and Electrical disturbances,

has provided a solution to many other problems, not only in the telephone art but also in other fields of communication and general signalling. Examples of some of its applications are detailed below.



Oscillogram of the operating-lag of the break contact.

IT HAS—

- ★ Enabled the speed of fast-moving vehicles over Street Traffic mats to be recorded with a high degree of accuracy.
- ★ Greatly facilitated and simplified certain forms of electrical countings.
- ★ Enabled the movement of reverse-drive ratchet switches to be stopped by a method which has long been sought by Telephone Engineers.
- ★ Enabled dialling and other signals to be repeated with a degree of fidelity and reliability unattainable with other types of relay.
- ★ Been applied in tens of thousands in signalling and other equipment outside the telephone field.

—AND IT MAY SOLVE YOUR PROBLEM—

For full particulars write to—

SIEMENS BROTHERS & CO. LTD.

Tel.: Woolwich 2020 WOOLWICH, LONDON, S.E.18 *Telegrams: "Siemens, Woolwich"*

Would you believe it

★ "Charlie the Cobblers Tipster" is one of those good old craftsmen who, before the war took pride in making high class handsewn footwear. Now he is a war worker helping to make good army boots just as fast as modern methods of production can turn them out. They call him a "Cobblers Tipster" because he screws on metal toe caps. His "hand made" methods were much too slow for this work, so Charlie approached us with his problem, and today he, and all his fellow workers use Black and Decker Holguns and Electric Screwdrivers. This is yet another operation in the nation's war effort where B & D Portable Electric Tools are stepping up production. Perhaps you can think of a process in your factory which can be speeded up by Black & Decker Portable Electric Tools.

Write for Catalogue 1.23.

Quicker and better with

Black & Decker

PORTABLE ELECTRIC TOOLS

BLACK & DECKER · LTD · HARMONDSWORTH · MIDDX.

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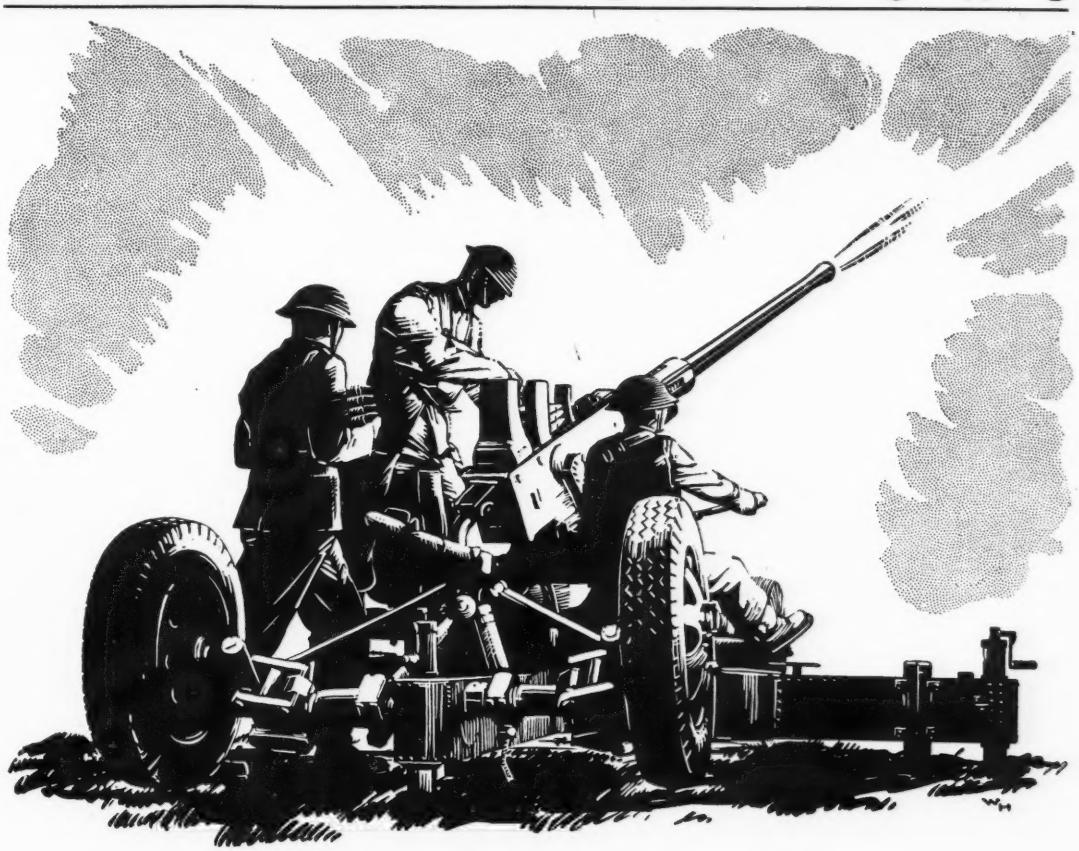
HIGH TRADITIONS



PERFORMANCE . . .

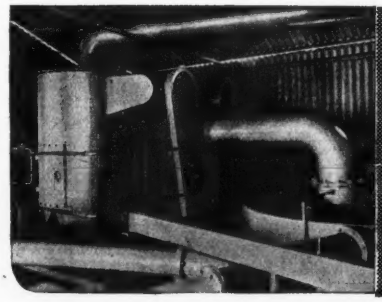
A BRITISH gun-crew in action is a marvel of speed and dexterity. Each man works with mechanical precision in close co-operation with his fellows. Such a high standard of performance is a tradition proudly upheld by the British Army, even under the most arduous conditions.

"Sirocco" Pneumatic Conveyance Plant is identified by a similar high tradition of performance, and finds wide employment in leading industries throughout the World.

"Sirocco" Equipment is used in Steam Raising Plants for handling ashes, flue dust, riddlings, soot, etc. while it fulfils efficient service in many industries for the local transportation of granular materials in divided form. "Sirocco" Pneumatic Conveyance Plant is easily installed, convenient, promotes clean conditions, and is silent in operation.

Catalogues Ref. SF209 and SF328 give complete details of both fixed and portable types and will be forwarded gladly on request.

INSTALL TRADE SIROCCO MARK PRODUCTS



The illustration shows a "Sirocco" Pneumatic Conveyance Plant in a large industrial works

DAVIDSON & CO. LTD.
Sirocco Engineering Works
BELFAST · Nth. IRELAND

Branch Depots: LONDON · CARDIFF
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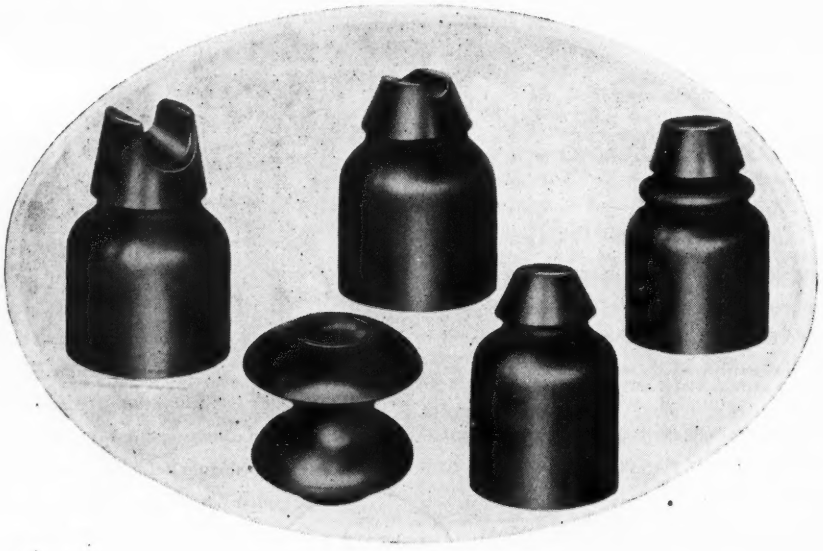
TEL·ENDURON .... INSULATORS

of NON-BRITTLE and MECHANICALLY STRONG PLASTIC COMPOSITION INSULATING MATERIAL

TEL·ENDURON insulators withstand rapid changes of temperature and do not crack. They pack economically into less cubic space than more brittle material—thus packing and shipping costs are appreciably reduced

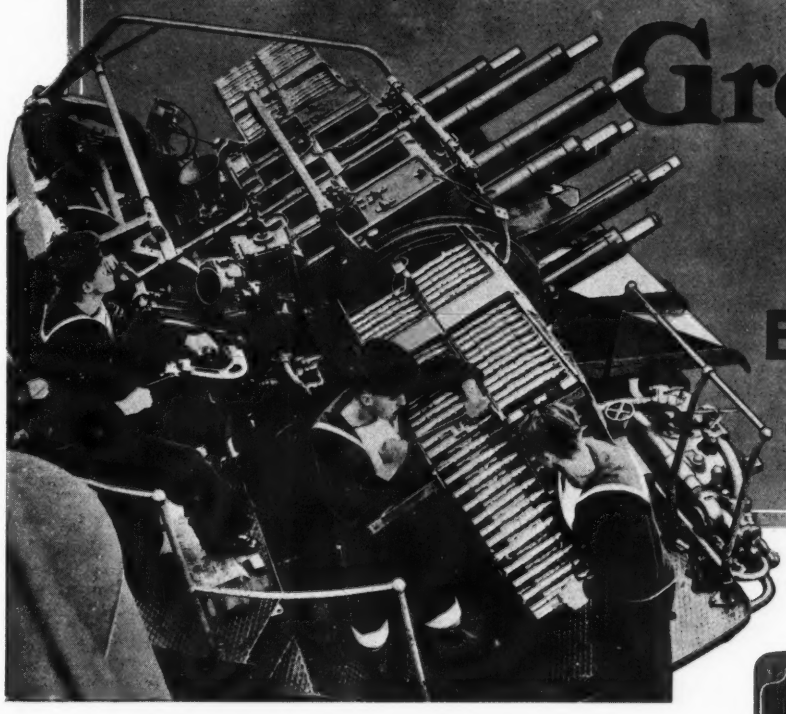


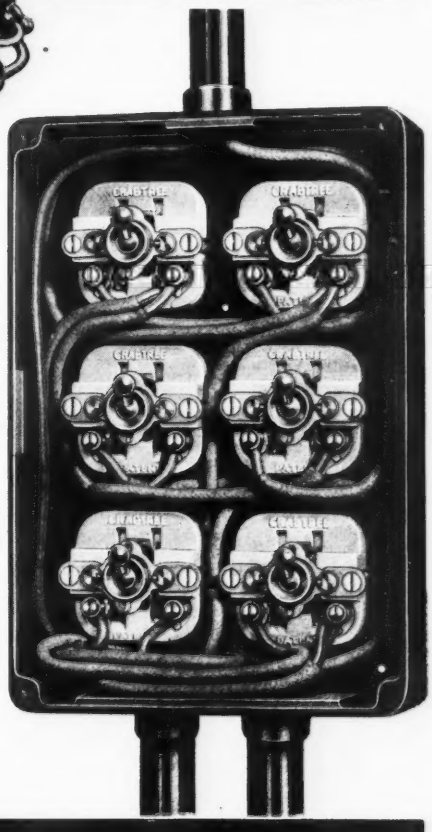
★ Write for latest Brochure containing Diagrams of Standard Models with National Physical Laboratory Tests

De La Rue
WALTHAMSTOW
Phone LARKSWOOD 2323

THOMAS DE LA RUE & CO. LTD., AVENUE WORKS, WALTHAMSTOW, LONDON, E.4

THESE BRITISH PRODUCTS ARE Grouped *for* EFFICIENT CONTROL





CRABTREE Multigang Ironclad Assemblies are similar in principle to the multiple "pom-pom" guns of a British warship. In the field of industrial production they play an equally important part since, as the 5 amp. assemblies are available in gangs of up to 25; and the 15 amp. units in gangs of up to 12, they provide reliable and efficient centralised control of electrical power services.

They are heavily armoured and their specially designed "protected" covers ensure that the operating "dollies" are exposed as little as possible to the rough handling likely to be imposed upon them during the present period of intensive manufacture.

The six-gang unit illustrated to the right clearly shows the generous amount of clearance for slack cable between and around the accessories, while the switches fitted as standard are provided with front-entry wiring terminals—a feature which enables all wiring connections to be completed with a minimum of delay.

CRABTREE

A · NAME · SYNONYMOUS · WITH · PROGRESS · IN · ACCESSORIES · AND · SWITCHGEAR

"Crabtree" (Registered)

C.538/82 Advt. of J. A. Crabtree & Co. Ltd., Walsall, England

B*

MATHER & PLATT LTD

Flameproof

BUXTON CERTIFICATED **MOTORS**

The working conditions in oil-fields and refineries, chemical works, collieries and other situations where Flameproof Motors are required, demand motors capable of continuous service often under very arduous conditions.

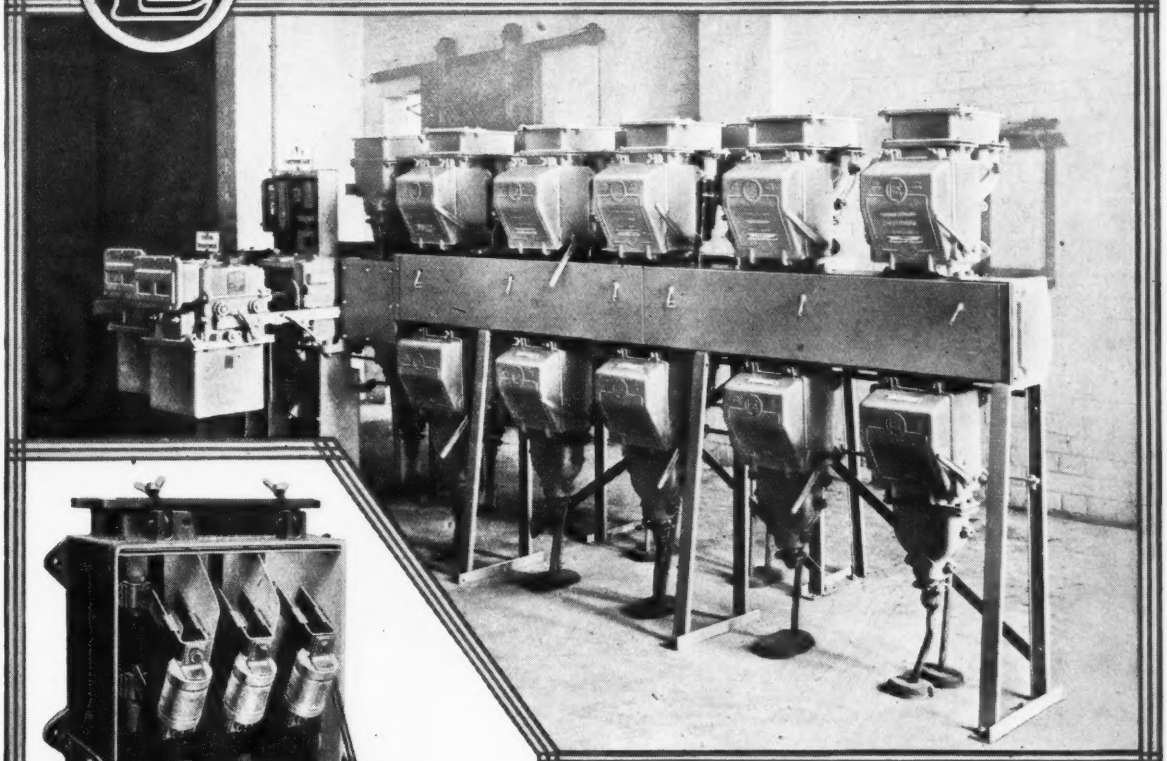
Mather & Platt motors are designed and built to give such service and that is why they are so widely used and appreciated.

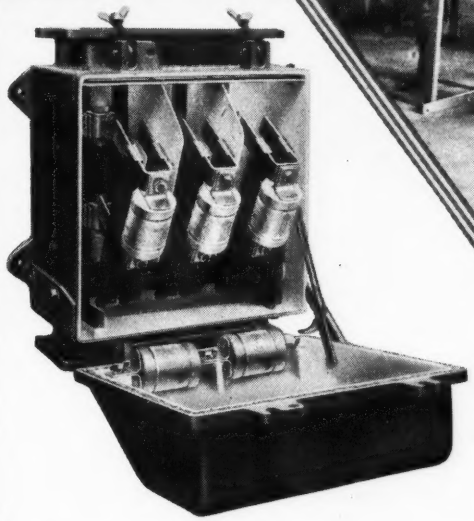
A most extensive range of Flameproof A.C. Motors is available, covered by H.M. Mines Department " FLP " Certificates.

For further details write to :

MATHER & PLATT LTD. MANCHESTER 10

FUSEGEAR





300 AMP. T.P. "COMBINATION" FUSE-SWITCH SHOWING CARTRIDGES ISOLATED FROM BOTH LINE AND LOAD CONTACTS.

Specify

DOUBLE ISOLATION

and be Safe

All 'English Electric' 'Combination' Fuse-Switch Units from 30 amps. to 750 amps. possess this valuable double isolation feature allowing cartridges to be handled with complete safety when the switch cover is open. They are therefore suitable for the control of inter-connector and all other types of circuits on which a 'feed-back' can be obtained under normal or emergency conditions.

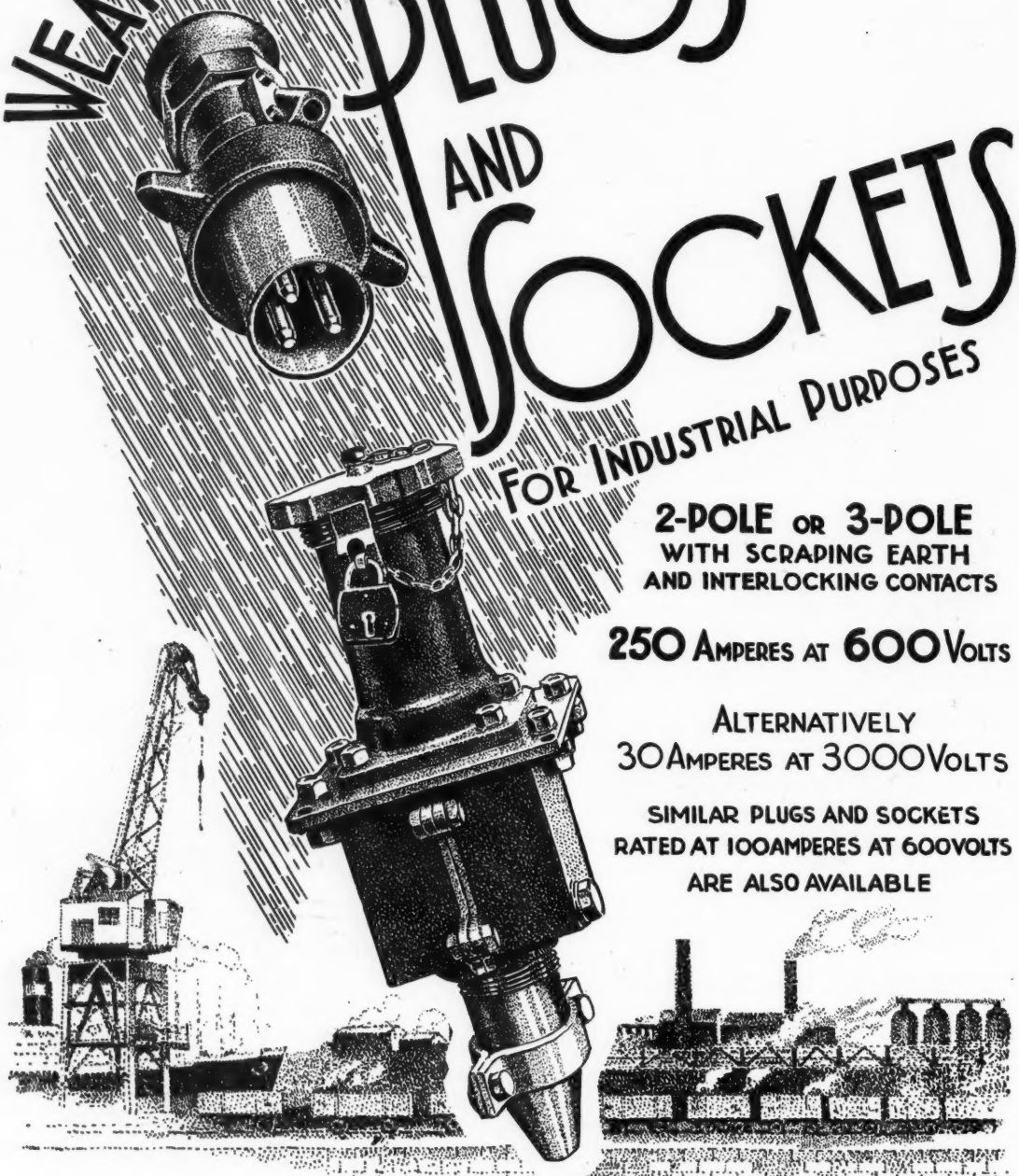
Write for publications to Publicity Department.

THE ENGLISH ELECTRIC COMPANY LIMITED

— STAFFORD —

WEATHERPROOF PLUGS AND SOCKETS

FOR INDUSTRIAL PURPOSES



2-POLE OR 3-POLE
WITH SCRAPING EARTH
AND INTERLOCKING CONTACTS

250 AMPERES AT 600 VOLTS

ALTERNATIVELY
30 AMPERES AT 3000 VOLTS

SIMILAR PLUGS AND SOCKETS
RATED AT 100 AMPERES AT 600 VOLTS
ARE ALSO AVAILABLE

A. REYROLLE & CO LTD

HEBBURN-ON-TYNE ENGLAND

A.S.C.M. Steel Conduit is manufactured only by :—

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Members of the Association of Steel Conduit Manufacturers are proud that their products are providing the very sinews of National Effort in buildings of National Importance, and that the well-established standards signified by the A.S.C.M. mark are playing as important a part in War as they did in peace and will again in the peace-time yet to come.

ADVERT. OF THE ASSOCIATION O STEEL CONDUIT MANUFACTURERS, 25 BENNETT'S HILL, BIRMINGHAM

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Permalloy (Magnetic Alloy)

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Moving Coil Microphones and Head Receivers
Speech Input Equipment (Mixers, Amplifiers, and Automatic Switching Equipment)
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Unit Type up to 2,400 pairs
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Cable Search Apparatus
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RADIO TRANSMITTING AND RECEIVING APPARATUS :
Commercial Radio Receivers
High Power Radio Telephone Telegraph Transmitters for Radio Links

It is impossible, within the scope of this announcement, to mention all the products manufactured by Standard Telephones and Cables Limited, and the list given above should be considered as but a brief summary of our activities.

ADVERTISEMENT OF STANDARD TELEPHONES AND CABLES LTD. (EXPORT DEPARTMENT), CONNAUGHT HOUSE, 63 ALDWYCH, LONDON, W.C.2

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Medium and Short Wave Radio Broadcasting Transmitters
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Telephone Sets and Associated Apparatus

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Cathode Ray Oscillograph Equipment
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Noise and Crosstalk Sets
Oscillators
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Telegraph Distortion Measuring Sets
Transient Recorders
Transmission Measuring Sets

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Indicators
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Ballast Lamps
Cathode Ray Oscillograph Tubes
Hot Cathode Mercury Vapour Rectifiers
(with and without grid control)
Transmitting and Receiving Valves
Vacuum Condensers
Vacuum Thermocouples

If any type of apparatus in which you are interested has not been mentioned, or, there are any communicatior problems in which the Company's engineers could assist, your enquiries will be welcomed

(Telegrams : RELAY TELEX, LONDON) BRANCHES AND REPRESENTATIVES THROUGHOUT THE WORLD

The new

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GLASS INSULATED WIRE

LEWCOGLASS REGD.

Pure Glass Insulation

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Resistant to Acids, Oils, etc.

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Operates at temperatures which would quickly destroy other types of insulation

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High Dielectric strength • Winding and Handling normal

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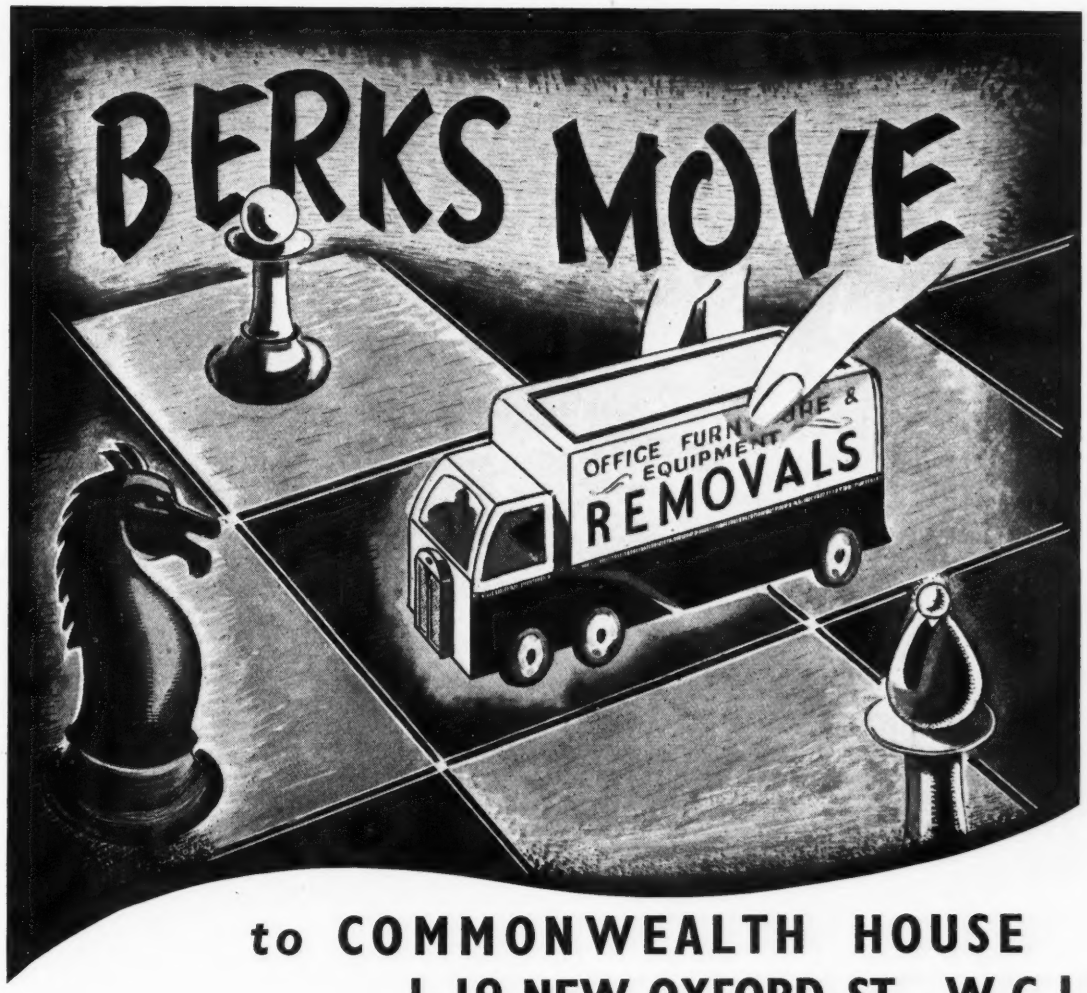

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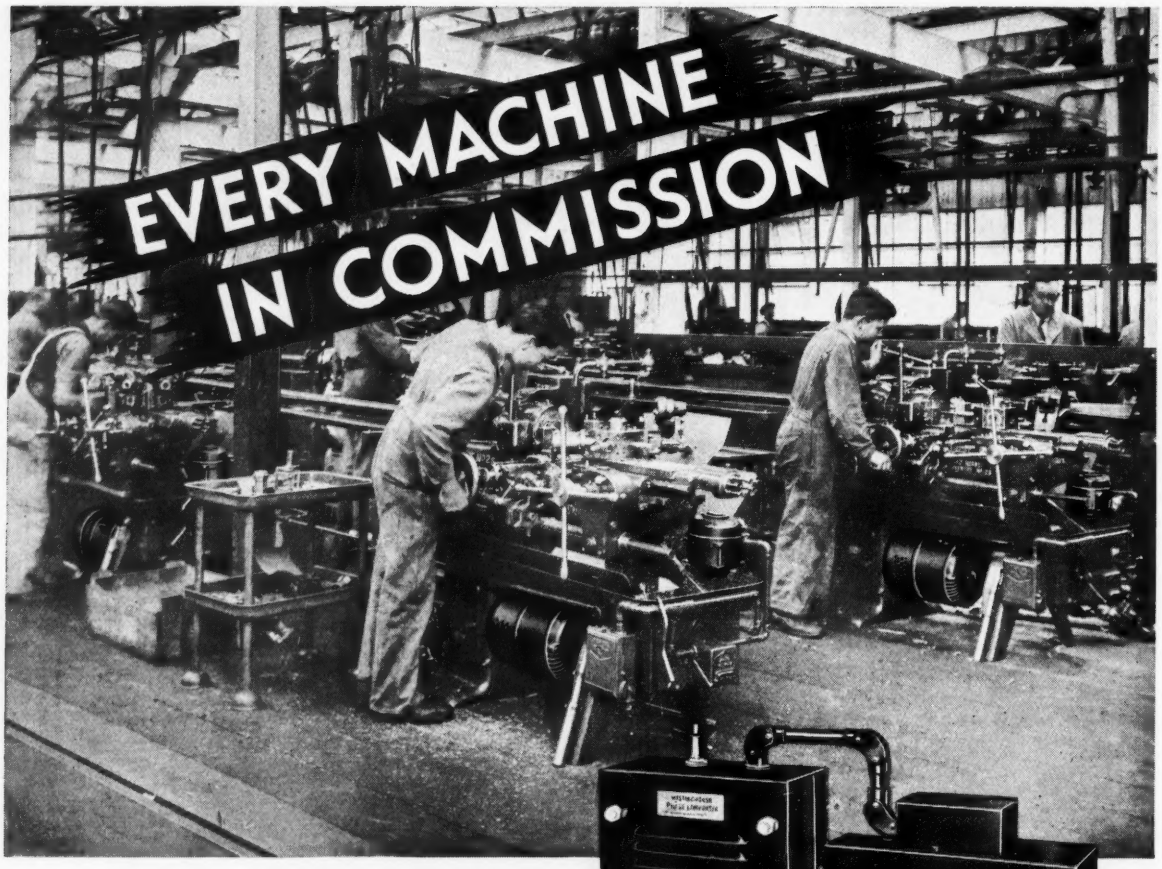
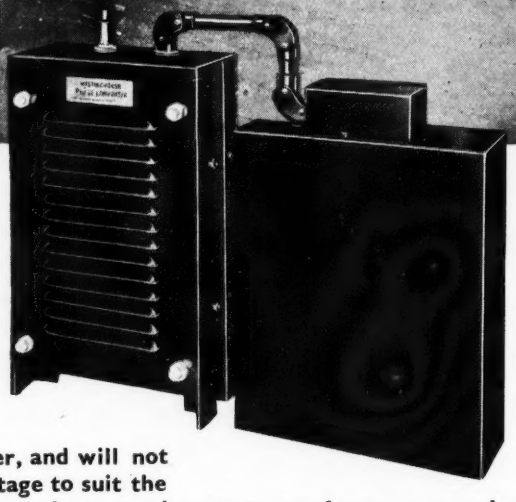


EVEN IF ONLY SINGLE-PHASE IS AVAILABLE



The Westinghouse Static Phase Converter will convert single to three-phase simply and efficiently. It is very easy to install, and costs nothing to run or maintain.

It comprises simply a reactance unit and a condenser, and will not only change the number of phases, but also the voltage to suit the machines it is required to operate. The input power factor and output waveform are good and, under normal conditions, the efficiency is of the order of 95%.

If any of your machine tools are out of commission due to only single-phase being available, you need this static phase conversion equipment.

WESTINGHOUSE

STATIC

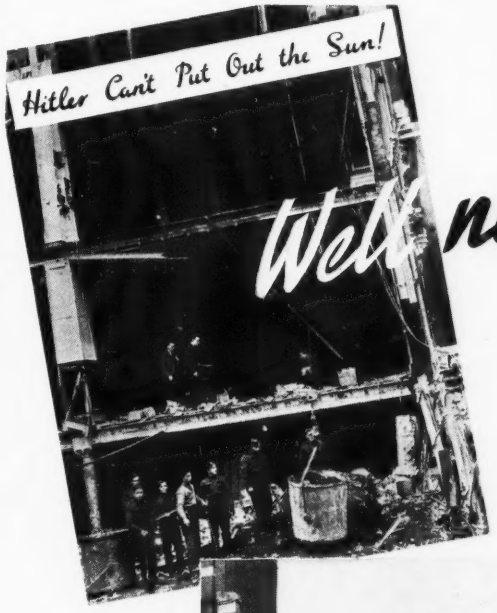
1 to 3 PHASE CONVERTER

Represented in INDIA by Saxby & Farmer (India) Ltd. Calcutta

Represented in AUSTRALIA by McKenzie & Holland (Australia) Pty. Ltd., Melbourne

Write for Descriptive pamphlet No. 11M to Dept. E.R.

WESTINGHOUSE BRAKE & SIGNAL CO. LTD., Pew Hill House, Chippenham, Wilts.

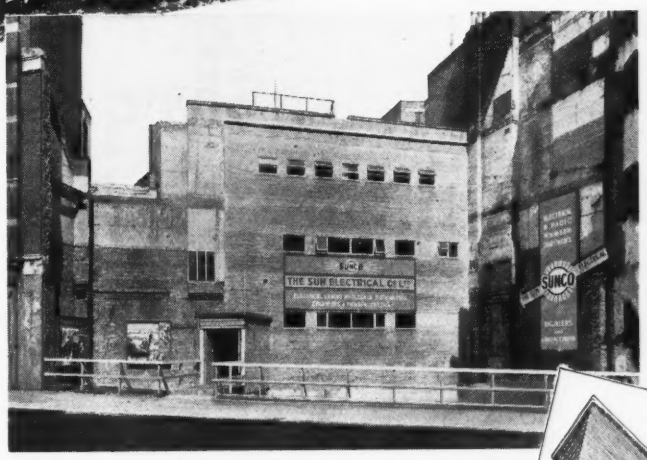


Well neither can he!

When this happened we produced the slogan "Hitler can't put out the Sun!"—a slogan which has had a certain popular appeal, not only here but in the U.S.A. as well. In fact the photo on the left was taken from the American Geographical Magazine.

But now we have cleaned things up a little, as shown below, and all Departments are in full swing again.

So that once more we can repeat the story which we have told for more than forty years in the pages of this journal—When you want Anything Electrical — get it at Sunco!



"The Shape of things to come..."

Barely had our old frontage disappeared in the smoke of war when we got busy on the new. Here is our Architects' impression of Sunco House in 19 . . (?)

Advertisement of the Sun Electrical Co. Ltd., 118/120 Charing Cross Road, London, W.C.2., and at Leeds, Newcastle-on-Tyne and Slough.

AN APPEAL TO CABLE USERS

ROLL OUT THE DRUMS

AND RETURN THEM **WITHOUT DELAY** TO YOUR SUPPLIERS

Every empty cable drum lying idle means a 'stop' on some vital source of supply. The war effort needs cables—cables need the idle drums.

KEEP THE CABLE DRUMS TURNING & HELP TO SPEED UP PRODUCTION

ISSUED IN THE NATIONAL INTEREST BY MEMBERS OF THE

CABLE MAKERS ASSOCIATION

Advt. of the Cable Makers Association, High Holborn House, 52-54 High Holborn, W.C.1. 'Phone : Holborn 7633

The nation cannot afford to permit slow moving carrying methods to sabotage production by causing 'waits'. Especially when ONE girl, with a truck, could release TEN men for more vital work.

NOT ONLY does the Douglas Truck speed up transport in ANY Factory—it liberates men from the drudgery of lifting and carrying. Driven by girls, often not strong enough for long hours at machines, Douglas Trucks are lumping loads of a ton or more from place to place in Factories all over the country.

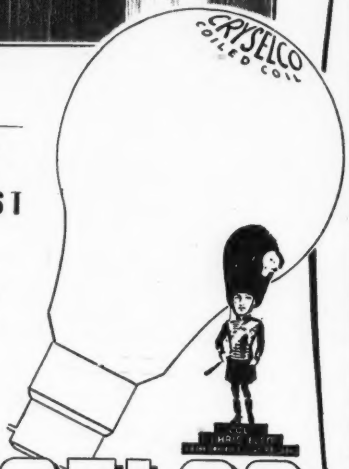
Do not tolerate the use of men for jobs which a girl—with a Douglas—will do better. *If, in your Works, there are no Douglas Trucks, write at once for details.*

The
Douglas
INDUSTRIAL TRUCK

DOUGLAS (KINGSWOOD) LIMITED, P.O BOX 1, KINGSWOOD, BRISTOL ENGLAND

Light
ON THE PAST

BLACK PRINCE
This statue was designed by Sir Thomas Brock who was born in Worcester, in 1847. This statue was unveiled in 1907.



CRYSELCO LAMPS

Lamps of Enduring Brilliance

CRYSELCO LIMITED, KEMPSTON WORKS, BEDFORD

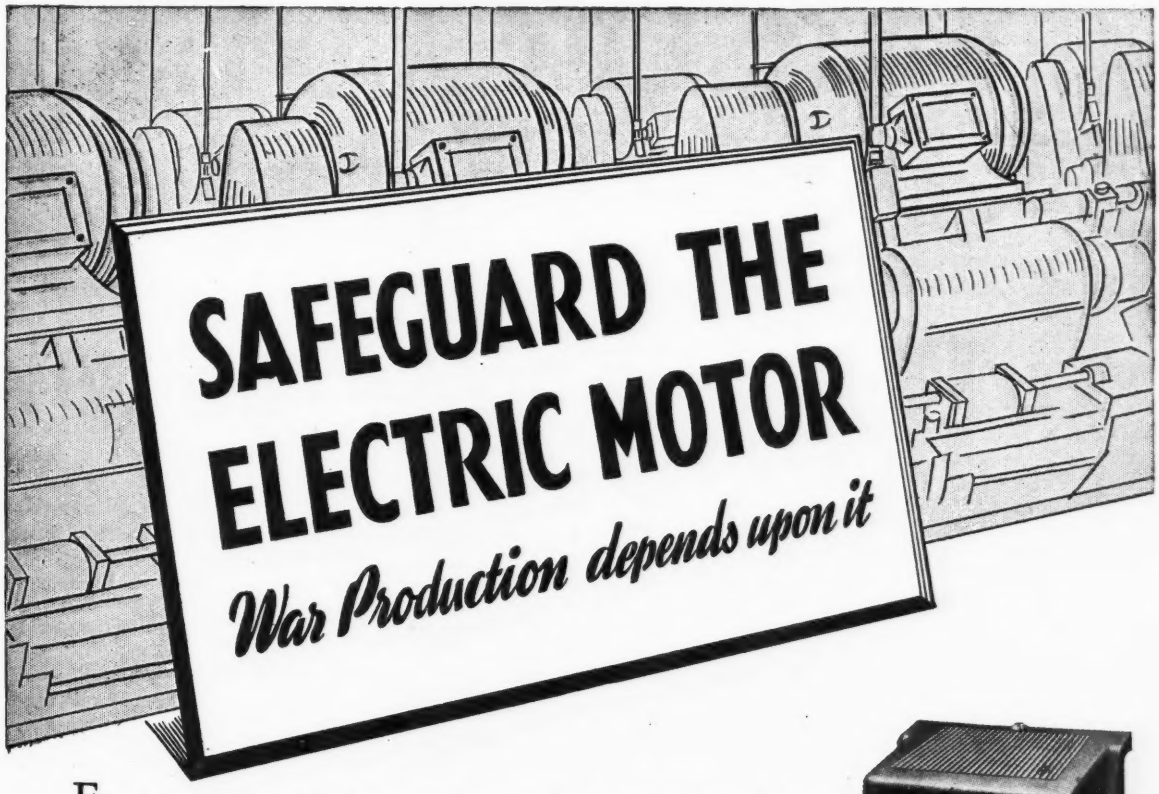
Perfect Mouldings

FOR THE ELECTRICAL & ALLIED TRADES

Please send us your inquiries—

Moulded Products Ltd., Chester Rd., Tyburn, B'ham.

Longleys



SAFEGUARD THE ELECTRIC MOTOR

War Production depends upon it

Electric motors provide the motive power of war production. It is important that they be given fair play, and the least that can be done is to safeguard them with reliable and fully protective starters.

The M.E.M. range of manual and automatic motor starters offers this protection in the fullest measure. They have the simplicity and efficiency of competent design. Their reliability has been proved in tens of thousands of installations.

M.E.M. Starters are products of Britain's largest self-contained factory specialising in switch and fuse gear—a factory that is a model of production efficiency. This alone accounts for their very moderate prices. The range meets every requirement for motors up to 15 h.p. with a maximum rating of 25 amperes. May we send you full particulars?

M·E·M

M.E.M. AUTO-MEMOTA AUTOMATIC PROTECTIVE STARTER *A fully automatic push-button starter with thermal overload trips which give complete protection to the motor while allowing its full thermal capacity to be utilised. No-volt release is inherent. A thoroughly robust and reliable starter.*

MOTOR CONTROL GEAR

"STARTET" DIRECT STARTERS

This ironclad push-button manually operated starter is suitable for ½ to ½ h.p. motors taking from .3 to 4.5 amperes where no-volt release is not required. Fitted with calibrated thermal overload trips it gives full protection. Its simplicity and reliability have made it a most popular starter.

PUSH BUTTON CONTROL STATIONS

M.E.M. manufacture a wide range of push-button control stations that meet every requirement. All cases and covers are of cast iron. "Stop" stations are enamelled red, while other stations are black. "Stop" buttons project beyond the "On" to ensure speedy selection. Inset and surface patterns available.

MIDLAND ELECTRIC MANUFACTURING CO., LTD., TYSELEY, BIRMINGHAM, 11

London Showrooms & Stores: 21-22, Rathbone Place, London, W.1. Manchester Showrooms & Stores: 48-50, Chapel Street, Salford, 3

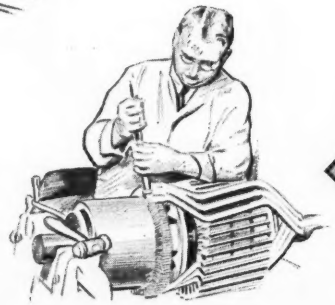
Specialists in Switch, Fuse and Motor Control Gear. *Manufacturers of High Efficiency Electric Fires.*

C

KEYS TO L.D.C. "LASTING RELIABILITY"...

4 Craftsmanship

Craftsmanship is a composite "intangible" that calls for knowledge that comes from years of experience, for the will to excel, for precision work and for quality of materials and workmanship. These are some of the components of the "Craftsmanship" that is part and parcel of each L.D.C. Motor; the "Craftsmanship" that is *one of the many reasons* why L.D.C. Motors are chosen by experienced Engineers, again and again, to ensure safe, economical and reliable service.



HAVE YOU READ THE BOOKLET
"CRAFTSMANSHIP"?

wherein Ted Reid, Len Holmes and other L.D.C. craftsmen tell of their interesting experiences with L.D.C. during the past forty years.

A few copies of "Craftsmanship" are still available and may be had on request from L.D.C. Ltd., Publicity Dept., 94 Petty France, London, S.W.1.

LANCASHIRE DYNAMO & CRYPTO LTD

TRAFFORD PARK, MANCHESTER, 17 — WILLESDEN, LONDON, N.W.10

Associated Companies:
FOSTER TRANSFORMERS & SWITCHGEAR LTD., WIMBLEDON, S.W.19 — CRYPTON EQUIPMENT LTD., WILLESDEN, N.W.10

The Tests are Good

Copyright Colonel Sir
Thomas F. Purves
Exclusive Licensees
Members of the C.M.A.

BUT WILL THEY STAY GOOD?

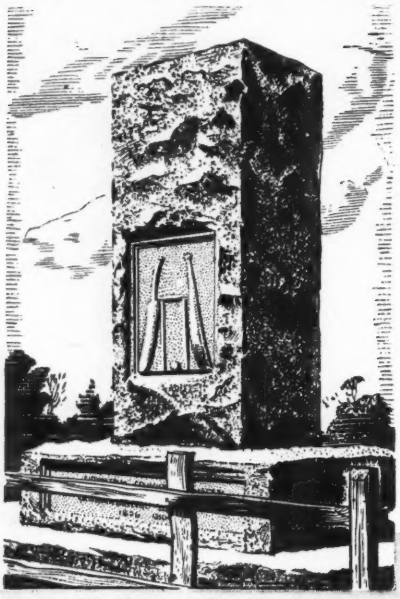
Will there be a good test after a lapse of years, or will there be increasing trouble, and eventually the job to do again? The test of time is the acid test, but it has one drawback—it takes time to apply.

J. & P. Cables

have already stood the test of time—we have been making them since 1875. The cables we make to-day have that experience behind them, and the quality in them which has built up our business and made it grow year by year through all those years, and spread all over the world. They are good, and they stay good. "Time" will pass them when he applies his test—

JOHNSON & PHILLIPS LTD.

Charlton, London, S.E.7



The Cradle of Cricket

THE premier English game appears to have derived its name from the French *criquet*. Its birth is a little obscure, but it is possible that a version of the game was played as far back as 1478. However, it was not until 1750 that the first English cricket club—The Hambledon—was formed. This memorial on Broadhalfpenny Down, near Hambledon, Hampshire, marks the site of the club ground. The inn in the background, appropriately enough, is named " The Bat and Ball."

A reminder of the historic wealth of our land and its industries, published by the originators of C.T.S. Cable.
ST. HELENS CABLE & RUBBER CO. LTD., SLOUGH (Slough 20333)

Manufacturers of

ST. HELENS CABLES

OIL IMMERSED CIRCUIT BREAKER

or

DIRECT ON STARTER

30 AMP. CAPACITY AS CIRCUIT BREAKER SUITABLE FOR 15 H.P. 440 VOLTS AS DIRECT ON STARTER.

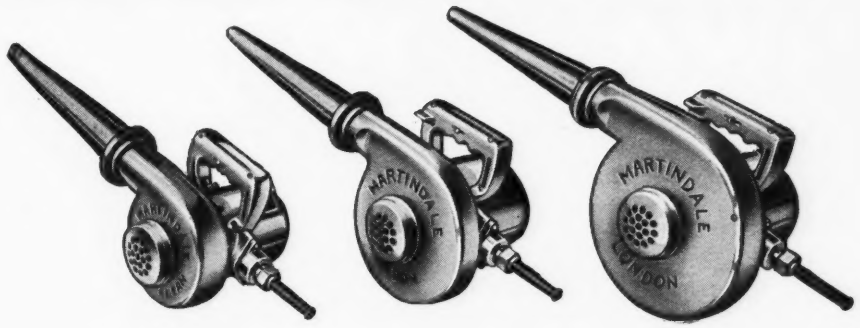
- **ROBUST** and simple construction ensuring long and trouble free service.
- **RENEWABLE CONTACTS.**
- **COMPETITIVE.**

VERITYS LTD.

● ASTON, BIRMINGHAM 6.

Sales Headquarters: BRETTENHAM HOUSE, LANCASTER PLACE, W.C.2.

MARTINDALE SUPER-BLOWERS



● The most efficient lightweight portable blowers ever put on the market. Precision-built, on interchangeable lines, and carefully balanced to eliminate vibration.

Armatures and coils hand-wound and impregnated to withstand all conditions of service all over the world.

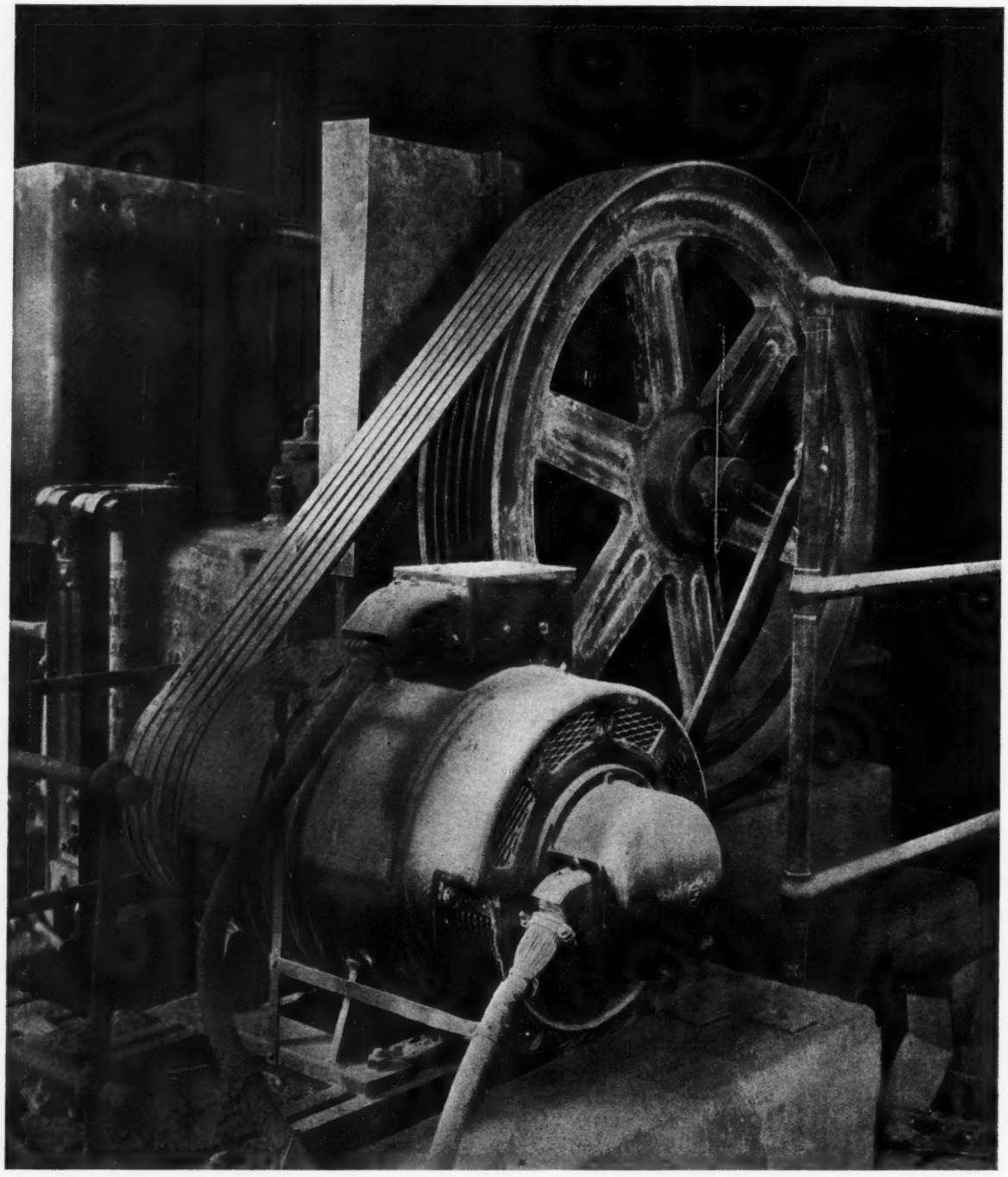
Three models (1) "Mill-type," (2) Standard and (3) "Blower-Clean." All models can be instantly converted into powerful industrial vacuum cleaners.

Write for new literature.

MARTINDALE

MARTINDALE ELECTRIC CO. LTD., WESTMORLAND RD., LONDON, N.W.9

Telephone: Colindale 8642-3 *Telegrams: Commstones, Hyde, London*



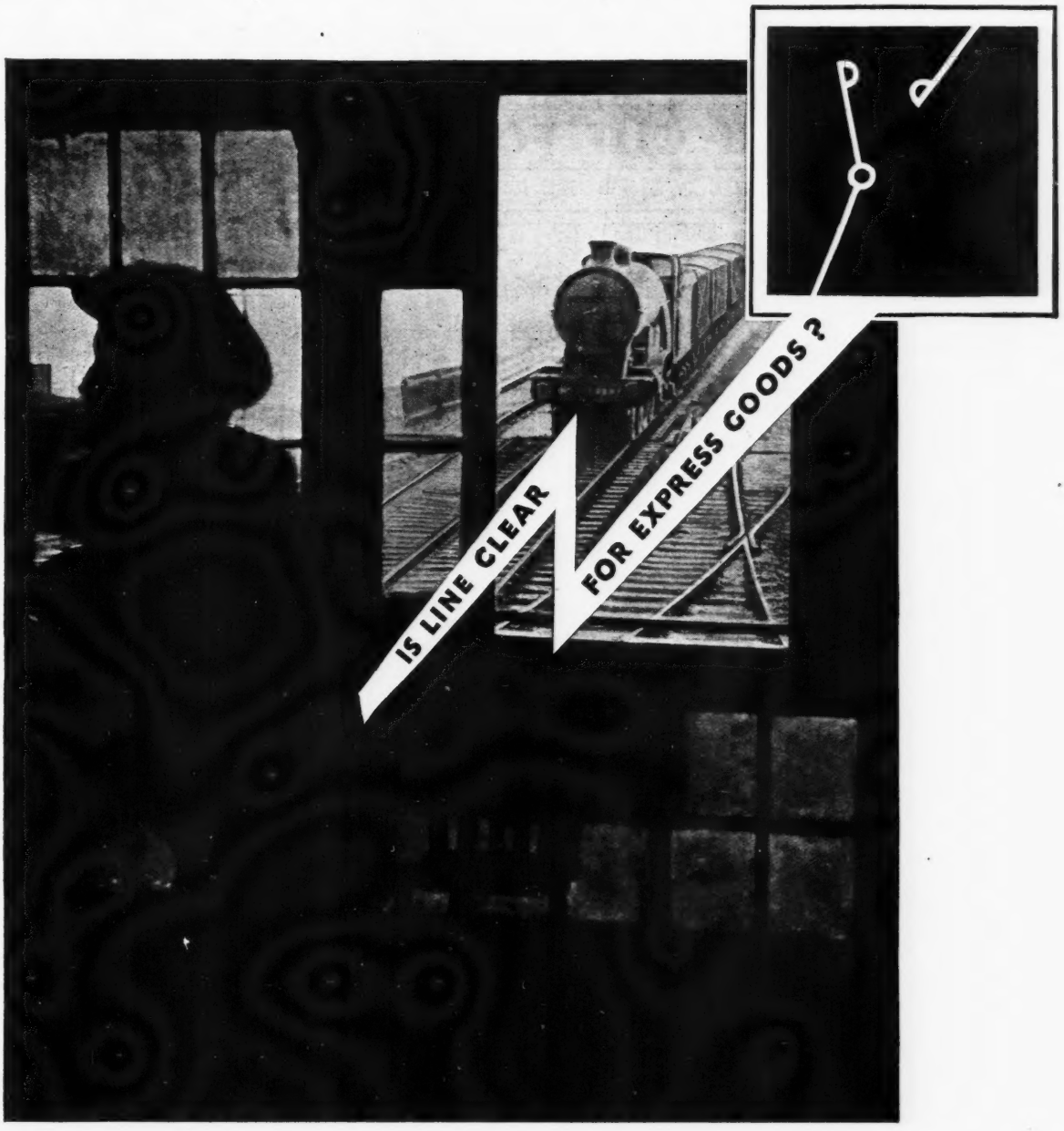
YOU NEED NOT PAMPER AN L.S.E. MOTOR

This is a situation (a stone quarry) for which we should have recommended an "EMCOL" totally enclosed motor. The customer, however, decided that a screen-protected L.S.E. machine would do the job, and he proved to be right. If even we under-estimate the qualities of L.S.E. motors, no wonder our customers are so satisfied !

LAURENCE, SCOTT & ELECTROMOTORS LTD.

SPECIALIST MAKERS OF ELECTRIC MOTORS FOR NEARLY SIXTY YEARS

NORWICH, MANCHESTER, LONDON AND BRANCHES



British Railways have risen to the occasion! They have undertaken cheerfully the task of maintaining passenger transport in the face of the ever-increasing demands for the prompt movement of the sinews of war along these "lines behind the lines". In the performance of this difficult task, the railways depend more than ever these days upon reliable communications from point to point. In this work BAKER precious metal Contacts — small components with a big responsibility — play their part. May we send you a free copy of our booklet "Precious Metals in the Electrical Industry" — it shows just why —

a good job needs

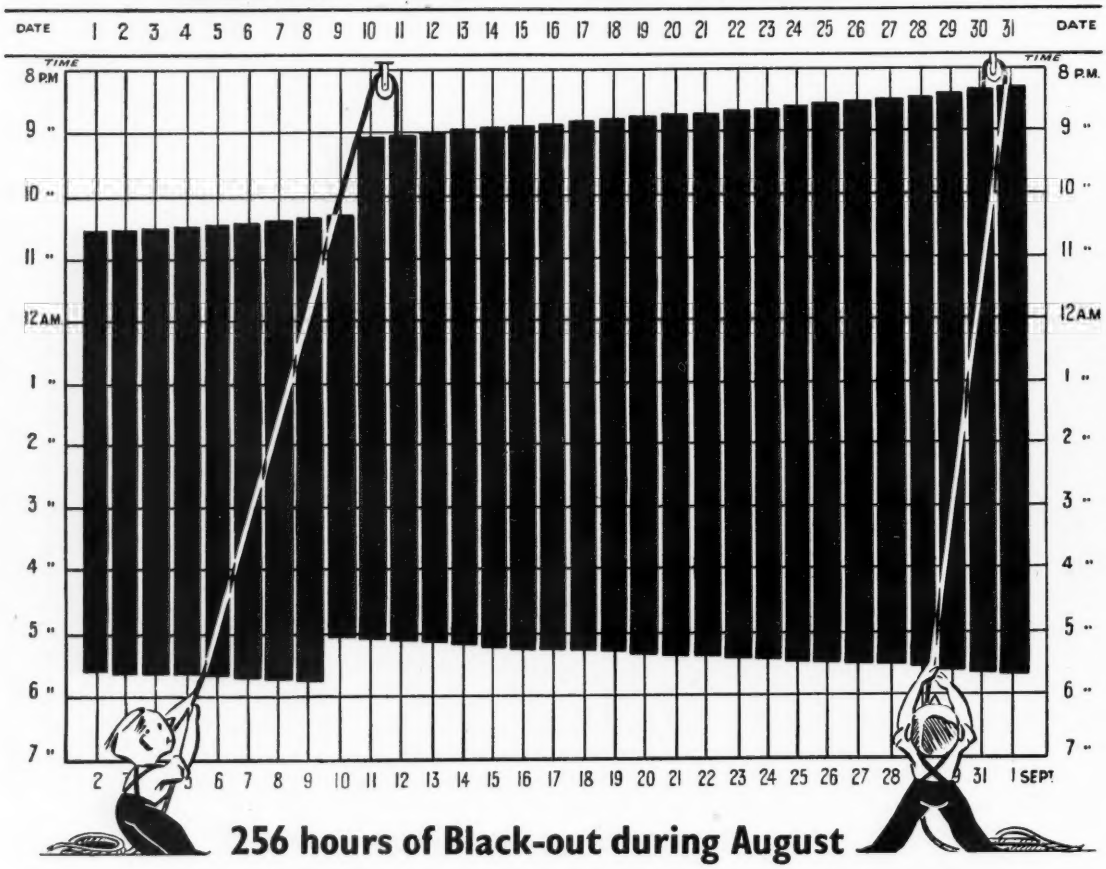
a Baker Contact

BAKER PLATINUM LTD 52 HIGH HOLBORN LONDON W.C.1. *Phone:* CHANCERY 8711

Let the change remind you . . . .

BLACK-OUT FOR AUGUST

Times are for London



256 hours of Black-out during August

In August, the extra hour of daylight is lost to the industrial war effort, and, besides, black-out hours increase alarmingly with the shortening days. Preparations are being made for Winter—lighting schemes adjusted to assist a still greater output, and Osram will continue to be the choice of all who demand of their lamps really dependable service under all conditions.

Osram

A G.E.C. PRODUCT

THE WONDERFUL LAMP

NATIONAL EMERGENCY. *Please assist by saving all packing material for collection when our van calls.*

Classified Advertisements

ADVERTISEMENTS for insertion in the following Friday's issue are accepted up to **First post on Monday,** at Dorset House, Stamford Street, London, S.E.1.

THE CHARGE for advertisements in this section is 2/- per line (approx. 8 words) per insertion, or for display advertisements 30/- per inch, with a minimum of one inch. Where the advertisement includes a Box Number there is an additional charge of 6d. for postage of replies.

SITUATIONS WANTED.—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES TO advertisements published under a Box Number if not to be delivered to any particular firm or individual should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Letters of applicants in such cases cannot be returned to them. The name of an advertiser using a Box Number will not be disclosed. All replies to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1. Cheques and Postal Orders should be made payable to ELECTRICAL REVIEW LTD. and crossed. Notes cannot be traced if lost in transit. They must therefore be regarded as being despatched at sender's risk. Alternatively they may be sent per registered post.

Original testimonials should not be sent with applications for employment.

OFFICIAL NOTICES, TENDERS, ETC.

CITY AND COUNTY BOROUGH OF BELFAST

Electricity Department

THE Electricity Committee invite tenders for the Supply, Delivery and Erection of :—
6.6-kV Armourclad Switchgear (Specification No. W.362).

Specification, with Form of Tender, may be obtained from the City Electrical Engineer and General Manager, East Bridge Street, Belfast.

Sealed tenders, endorsed with the name and address of the firm tendering, and marked "Tender for Armourclad Switchgear, Electricity Department," to be lodged in, or posted so as to arrive at, my office not later than 5 p.m. on Friday, 1st August, 1941.

Parties tendering must comply with the Council's Standing Orders relating to Extras, Wages, Hours of Labour, etc.

The lowest or any tender will not necessarily be accepted.

An official receipt must be obtained for every tender delivered by hand. Tenders sent by post should be registered.

JOHN AUBER,
Town Clerk.
643

COUNTY BOROUGH OF DARLINGTON

Lighting of Communal Shelters

TENDERS are invited from Registered Electrical Contractors for the installation of electric light equipment in 263 communal shelters situated within the Borough. Plans and conditions of contract may be seen and the specification and form of tender may be obtained on application to the Borough Surveyor, Town Hall, Darlington. The deposit of a sum of £1 1s. will be required, and will be returned after receipt of a bona fide tender.

Tenders, endorsed "Lighting of Communal Shelters," to be delivered to the undersigned not later than 1 p.m. Friday, 1st August, 1941.

H. HOPKINS,
Town Clerk.

11, Houndgate,
Darlington.
July, 1941. 641

SITUATIONS VACANT

MERSEY POWER COMPANY LIMITED

APPLICATIONS are invited for the position of Shift Charge Engineer at the Company's Generating Stations.

Applicants should possess a sound technical training and should have experience in the control and operation of large modern generating stations.

Salary—N.J.B. Scale, Class H, Grade 8, at present £403 per annum.

Applications, stating age and giving full particulars of experience, qualifications, education, present position and salary, date when duties can be taken up, together with copies of recent testimonials, should be addressed as below and received not later than Wednesday, August 13th. Envelopes must be endorsed "Shift Charge Engineer."

Director and Engineer,
Mersey Power Company Limited,
Roche House,
Runcorn. 656

SITUATIONS VACANT—*Continued*

BOROUGH OF HARROGATE

APPLICATIONS are invited for the following positions :—

(a) Power Station Superintendent

(b) Consumers' Engineer.

(a) Power Station Superintendent : Applicants must have had a sound electrical and mechanical training and experience in the efficient running of a modern Generating Station, preferably in conjunction with the Central Electricity Board's Grid System of Supply.

Salary in accordance with N.J.B. Schedule, Grade 3, Class F, at present £555 per annum.

(b) Consumers' Engineer : Applicants must have a sound technical knowledge and Engineering experience in addition to experience involving the control of Showrooms, the handling of enquiries from Industrial and Domestic Consumers, the maintenance of all types of appliances and the negotiation of terms for supplies of electricity.

Salary in accordance with N.J.B. Schedule, Grade 4, Class F, at present £496 per annum.

The successful candidates will require to pass a medical examination, as the appointments are subject to the provisions of the Local Government and Other Officers Superannuation Act, 1937. Applications, endorsed "Power Station Superintendent" or "Consumers' Engineer," stating, age, qualifications and experience, together with copies of not more than three recent testimonials, should be addressed to Mr. A. Kelso, A.M.I.E.E., Electricity Offices, Municipal Offices, Harrogate, and must be received not later than Friday, 15th August, 1941.

The Standing Orders of the Council provide that—

(a) Canvassing of members of the Council or any senior Officer of the Council, directly or indirectly, will disqualify the applicant;

(b) Applicants shall disclose in writing whether they are related to any member of, or the holder of any senior office under the Council. Failure to do so will disqualify the applicant.

J. M. DODDS, LL.B.,
Town Clerk.

Municipal Offices,
Harrogate.
15th July, 1941. 638

CITY OF COVENTRY

Electricity Department

Switchboard Attendants

APPLICATIONS are invited for TWO Switchboard Attendants at the Corporation's Generating Station.

The appointments are designated under the Local Government and Other Officers' Superannuation Act, 1922, as amended in regard to annuities to Widows by the Coventry Corporation Act, 1936, and the selected candidates will be required to pass a Medical Examination.

The salary will be in accordance with the National Joint Board Schedule, Class "H," Grade 9a, which is, at present, £295 per annum.

Applications, stating age, training and experience, together with copies of not more than three recent testimonials, should reach the undersigned not later than 10 a.m. on Wednesday, 6th August, 1941.

W. J. MARSTON,
Electrical Engineer and Manager.

Council House, Coventry.
18th July, 1941. 652

SITUATIONS VACANT—*Continued*

COUNTY BOROUGH OF WOLVERHAMPTON

Electrical Engineer's Department

Mains Assistant

APPLICATIONS are invited for the above-named position from qualified engineers who have had a sound technical training and experience in the Distribution Department of a large Supply Undertaking. Candidates will be required to possess experience in the installation and maintenance of all types of underground and overhead mains for all pressures up to and including 33 kV, and must also have had experience in the equipment and maintenance of static substations.

Condidates must possess qualifications necessary for corporate membership of the Institution of Electrical Engineers.

The appointment will be in accordance with the Schedule of Salaries and Conditions of Employment of the National Joint Board, Class H, Grade 8. The salary will be £399 per annum plus cost of living for July 1st, 1941 (not yet published), and will be subject to deductions in accordance with the provisions of the Local Government Superannuation Act, 1937; the successful candidate will be required to pass a satisfactory medical examination.

Applications, giving particulars of age, general and technical training and experience, accompanied by copies of three testimonials and endorsed "Mains Assistant," to be delivered to the undersigned not later than Monday, July 28th, 1941.

J. BROCK ALLON,
Town Clerk.

Town Hall,
Wolverhampton. 598

COUNTY BOROUGH OF DERBY

Electricity Supply Department

Station Superintendent

APPLICATIONS are invited for the post of Station Superintendent at the Generating Station, Full Street, Derby.

The salary (and conditions of service) will be in accordance with the N.J.B. Schedule, Grade 3, Class "J," the present salary being £699 per annum.

The appointment is subject to the provisions of the Local Government Superannuation Act, 1937, and the selected candidate will be required to pass a medical examination.

Applications will only be considered from engineers of not more than 45 years of age, with sound theoretical training, and who have held a responsible post in a Generating Station of not less than 60,000 kW. capacity. Pulverised Fuel experience will be a recommendation, and Corporate Membership of the I.E.E. is essential.

Applications endorsed "Station Superintendent," stating age, particulars of training and experience, when able to commence duty, and references, should reach the undersigned not later than 31st July, 1941.

F. H. POOLES,
Borough Electrical Engineer.

36 Full Street, Derby.
15th July, 1941. 660

SITUATIONS VACANT—*Continued*

COUNTY BOROUGH OF BLACKBURN

Electricity Undertaking

APPLICATIONS are invited for the position of Lady Demonstrator of Electric Cooking and Domestic Appliances. Candidates must have experience in similar capacity, and preference will be given to applicants possessing the Electrical Association for Women's diploma for Demonstrators or equivalent. The salary will be £195 per annum (plus 6% temporary war bonus).

The selected candidate will be required to pass a medical examination and the appointment will be subject to the provisions of the Local Government Act, 1937.

Applications, stating age, qualifications, experience and copies of two recent testimonials, must be sent to the Engineer and Manager, Electricity Offices, Jubilee Street, Blackburn, in an envelope endorsed "Lady Demonstrator," and received not later than 9 a.m. Tuesday, August 5th, 1941.

CHAS. S. ROBINSON,
Town Clerk.

Town Hall,
Blackburn. 636

BURGH OF PAISLEY

Electricity Department

Mains Assistant (Temporary)

APPLICATIONS are invited for the above position, which is a temporary appointment for the duration of hostilities, with probable permanency for suitable candidate.

Applicants must be of reserved age and have sound technical training and practical experience with erection and maintenance of switchgear, plant and underground cable systems.

The salary and conditions will be in accordance with the N.J.B. Schedule, Class F, Grade 9a.

Applications are to be made on the prescribed form obtainable from the undersigned and returned not later than August 16th, 1941.

D. ROSS,
Engineer and Manager.

27 Blackhall Street,
Paisley.
July, 1941. 655

AYRSHIRE ELECTRICITY BOARD

District Superintendent

APPLICATIONS are invited for the above position from Engineers who have had experience in construction and maintenance of E.H.T. and L.T. overhead lines, the laying and maintenance of E.H.T. and L.T. cables, and the construction and maintenance of Transformer Sub-Stations. Salary £400 per annum plus War Bonus and House free of rent, rates and taxes. Applications, stating age, experience and the earliest date duties could be commenced, together with three copies of testimonials, to be sent to the undersigned not later than the 31st instant.

WM. C. BEXON, M.I.Mech.E., M.I.E.E.,
Engineer and General Manager.

Greenholm Street,
Kilmarnock. 657

ASSISTANT Mains Engineer required with experience in all classes of underground and overhead construction and operation, and also layout of sub-station equipment. Applications, endorsed "Assistant Mains Engineer," should reach The Northampton Electric Light & Power Co., Ltd., 25, Bridge Street, Northampton, not later than first post on Wednesday, August 6th. 642

ASSISTANT Working Storekeeper for taking control of stock with firm of wholesale electrical suppliers. Apply by letter or call.—British Central Electrical Co., Ltd., 6 & 8, Rosebery Avenue, E.C.1. 653

DRAUGHTSMAN required, experienced in layout of boiler and ventilating plant rooms; experience of Diesel engine generating sets an advantage. Full particulars, salary required to—G. N. Haden & Sons, Ltd., 19/29, Woburn Place, W.C.1. 623

ELECTRIC Lamp Manufacturers require, for the duration, experienced man not liable for military service qualified for works or production management. Write, stating age, experience and salary required, to—Box 648, c/o The Electrical Review.

SITUATIONS VACANT—*Continued*

ELECTRIC Lamp Works require man to train as an assistant foreman in an exhausting department. Some knowledge of glass blowing and the repair of laboratory glass work is necessary.—Give full particulars by letter to Cryselco Limited, Kempston Works, Bedford. 582

FEMALE Supervisor to undertake development and control, fractional motor rewinds, 100 miles outside London. Confidential, efficient. Experience, salary.—Box 6972, c/o The Electrical Review.

GOOD position offered to Mechanical Engineer with thorough experience of I.C. engine plant, reconstructional work, shop organisation, labour control. Details, with references and salary required, to—Box 661, c/o The Electrical Review.

LADY Demonstrator. Applications are invited for the position of Senior Lady Demonstrator, able to conduct lecture demonstrations in connection with cooking and domestic electric appliances in general. Experience with an electricity supply undertaking essential. State age and give full details of training and experience to—The Northampton Electric Light & Power Co., Ltd., 25, Bridge Street, Northampton. 6973

OLD-established Company of Wholesale Radio and Electrical Distributors require representative with connection in Northern Counties, Scotland and North Wales. Remunerative position and good prospects. Write—E.C.W., c/o Dixons, 43, Great Marlborough Street, W.1. 651

SUPERVISING Electrician required by small London contractor; must be used to Government contracts. Permanency to suitable applicant. Full particulars, wages, etc., to—Box 614, c/o The Electrical Review.

SUPERVISOR reqnired by Electric Lamp Manufacturers. Previous experience of electric lamps is not necessary, but a fair mechanical and electrical knowledge, and, if possible, some knowledge of high vacuum technique, is desirable.—Give full particulars by letter to Cryselco Limited, Kempston Works, Bedford. 581

TECHNICAL Scientist wanted by Electric Lamp Manufacturers to investigate problems in connection with Neon tubes, and to act in a supervisory capacity. Must have good knowledge of physics and chemistry, and if possible some experience of electrical discharges in gases.—Give full particulars by letter to Cryselco Limited, Kempston Works, Bedford. 580

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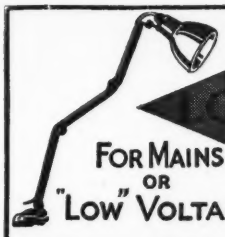

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TRIONITE SAND CASTINGS
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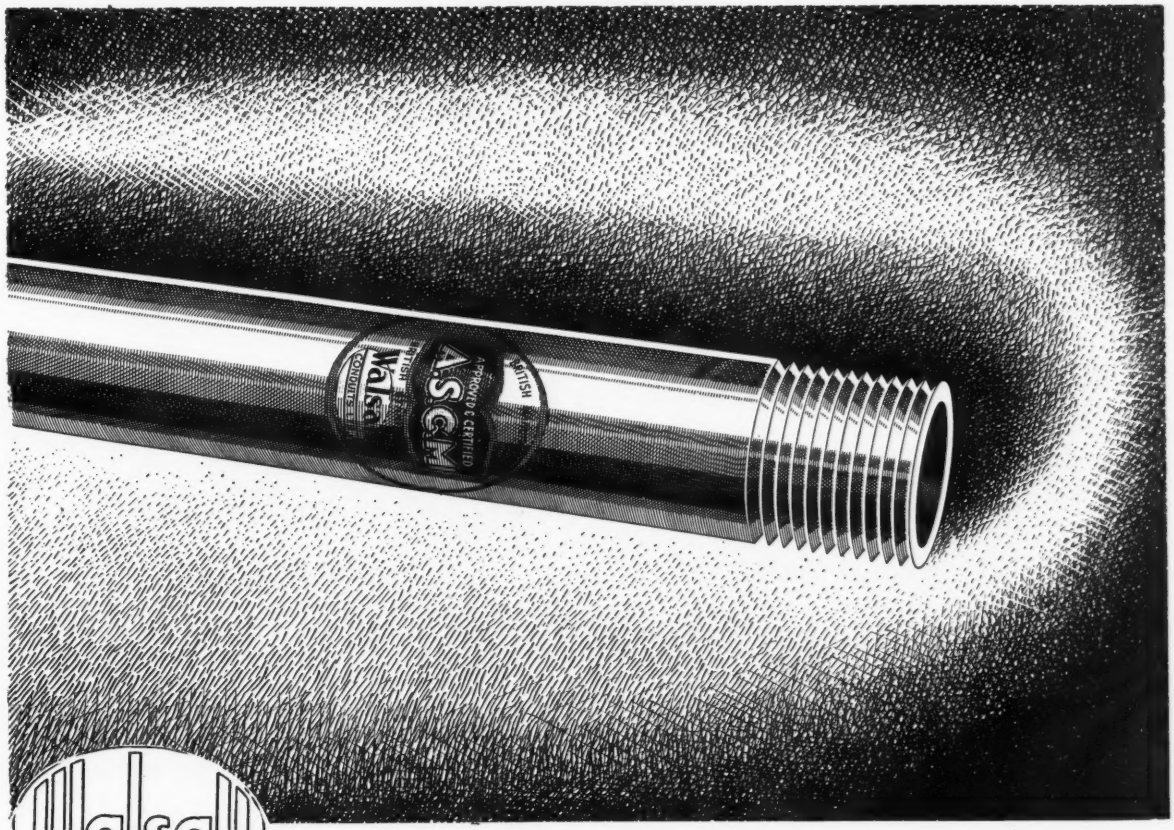

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No Conduit (or any other detail of an installation) can command the preference of Electrical experts unless thoroughly deserving it. Even then—it takes time to merit their approval, which in turn demands the test of Time upon Conduit itself . . . . . in proved durability. Likewise to manufacture "Walsall" conduit takes time, because of the many EXTRA processes that make it EXTRAordinary in detail of manufacture and finish. After all, attention to small details count in the "long run."

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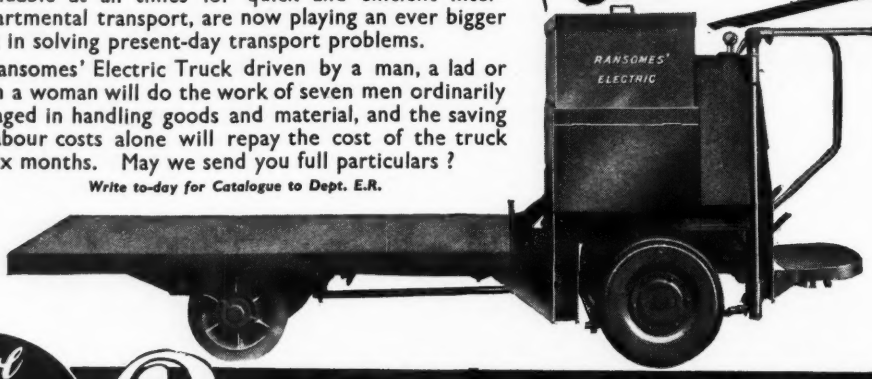

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battery chargers or rectifiers to meet your requirements

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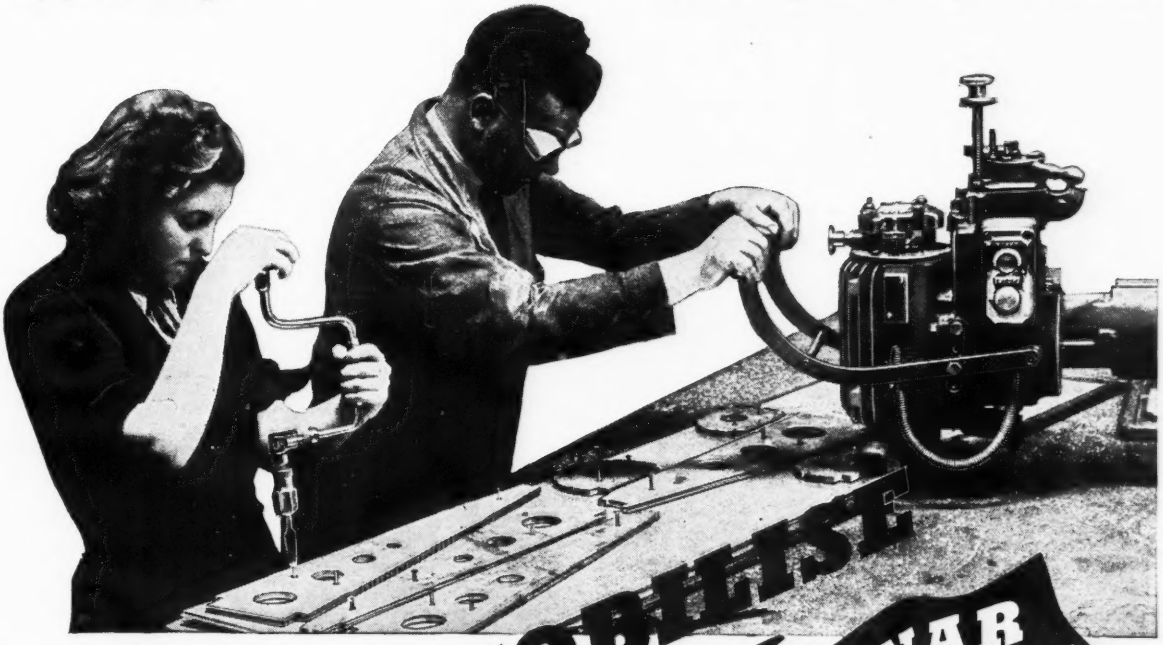
If you have any problem of this nature on which you feel you would like advice, remember that the Labour Supply Inspectors of the Ministry of Labour and National Service are ready and anxious to assist you. Do not hesitate to call them in. You can reach them through the Manager of your Local Employment Exchange.

The above is Point No. 1 of the Ministry of Labour's "4-POINT PLAN TO INCREASE WAR PRODUCTION" addressed to Management.

THE OTHER 3 POINTS IN THE PLAN ARE

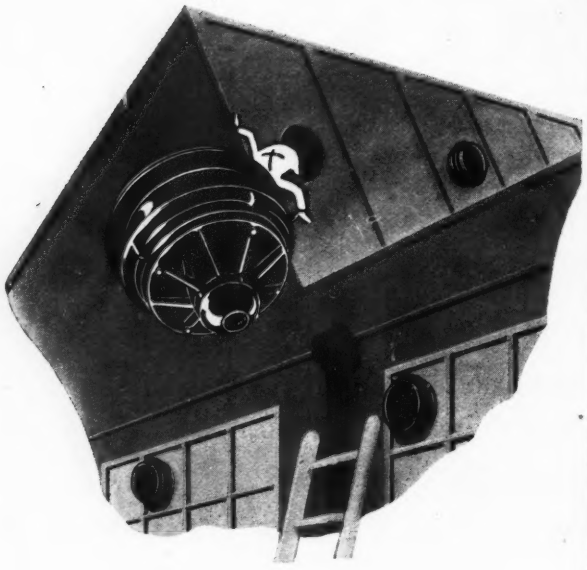
2. **Training Schemes must be developed to the greatest possible extent.**
3. **Prepare, now, to employ more and more women.**
4. **Efficient personnel management is essential.**



MOBILISE FOR WAR WORK

REMEMBER! If you have not yet received your copy of the "EMPLOYMENT OF WOMEN . . . SUGGESTIONS TO EMPLOYERS" instruct your secretary to write for one to-day (asking for pamphlet 87/1941) to the Manager of the Nearest Office of the Ministry of Labour and National Service.

ISSUED BY THE MINISTRY OF LABOUR & NATIONAL SERVICE



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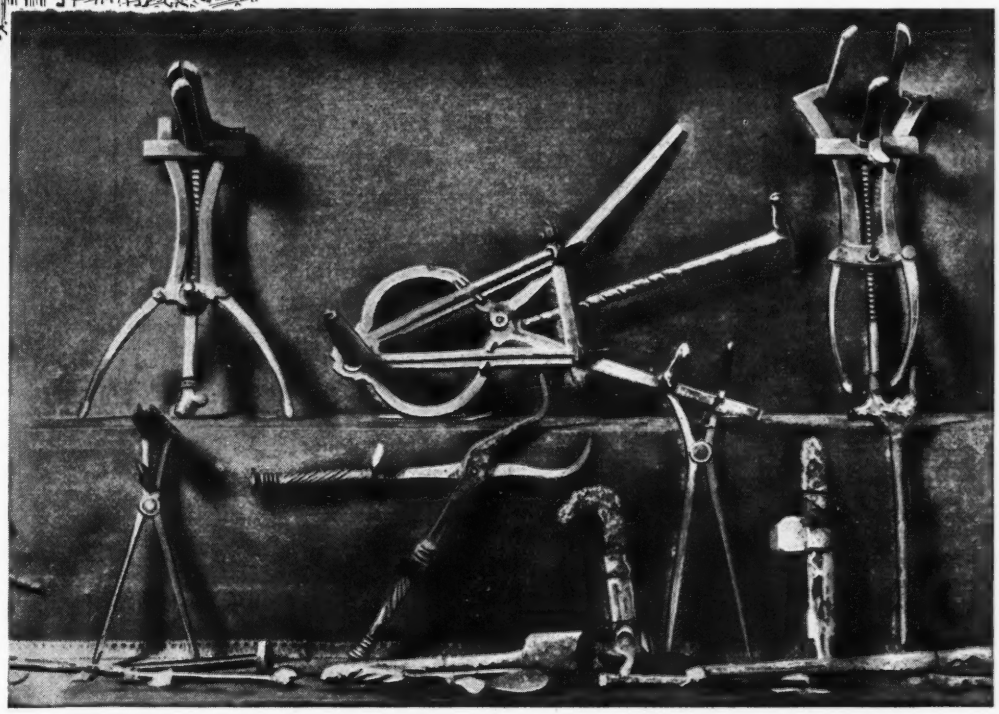
TO THE ELECTRICAL INDUSTRY!..



An illustration of Surgical Instruments found in the ruins of Pompeii, a City of Ancient Rome buried by an eruption of Mount Vesuvius: from "TRIUMPH OVER PAIN" by M. René Fueloep-Miller (Hamish Hamilton): submitted by Mr. R. A. Stroud of Sutton.

For years we have been under the impression that our product embodied entirely NEW principles, but the above illustration reveals that similar Tools were in use 2,000 years ago! The striking resemblance between the instruments at top left and right and the Hellermann Tool shown here has to be seen to be believed. We always knew it to be good, but never so well established. . . . !

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Full fire protection of oil-filled electrical plant is peculiarly difficult and requires specially developed equipment. Atlas have given special study to this problem and have developed two systems—the "Oilfyre" Atomised Water System and a CO_2-Gas System. Which of these two systems is the better depends on circumstances, and Atlas' experience is readily available to decide this for you.

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ATLAS CO_2-GAS SYSTEM

With this system the fire is smothered by carbon dioxide gas, thus excluding all oxygen. Both automatic and hand operated equipment are available. This gas is clean, dry, non-corrosive, inert and harmless, and so does not injure the plant in any way. It is stored under pressure in cylinders and does not deteriorate with age.

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COMPANY LIMITED

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When ordering, the voltage and type of bit required (Long, Short, or Right-Angle), should be specified.

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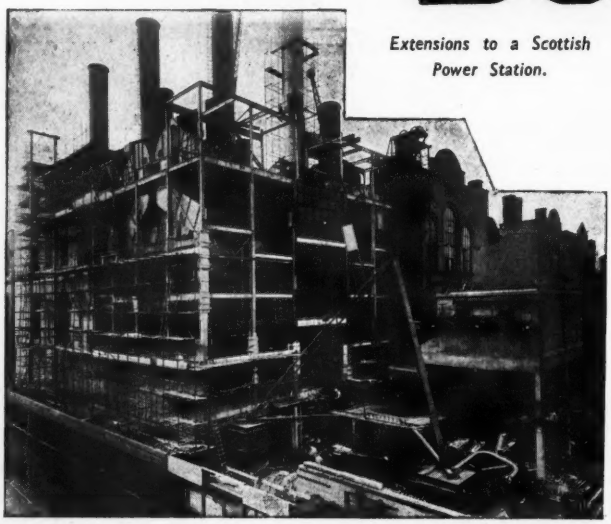

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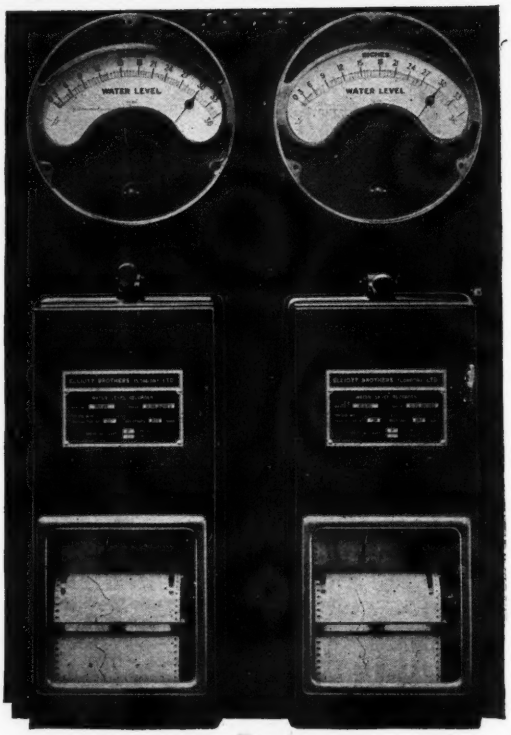

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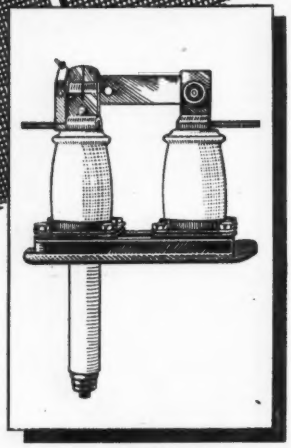

ONE can admire a man for standing up to his principles — however mistaken he may be.

It is, however, a great tribute when MANY admire a particular Industrial Product for outstanding principles of design from which it CAN NOT and WILL NOT depart.

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We only know that they are VERY GOOD—an opinion that users seem to share.

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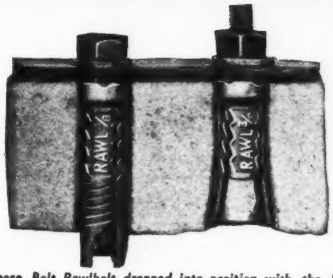
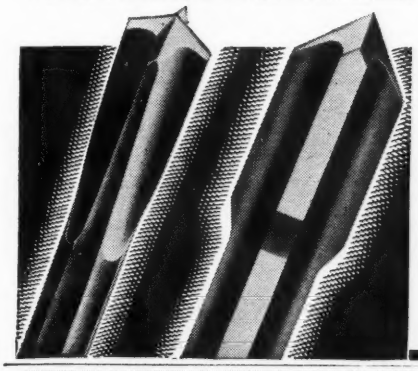
RAWLBOLTS & TOOLS



A Loose Bolt Rawlbolt dropped into position with the Bolt Projecting Type shown expanded on tightening down the fixture



RAWLBOLTS

Rawlbolts are designed for really heavy fixing work and they enable anything to be bolted in position with a minimum of time, labour and tools. There is no waiting for cement to dry and only a small diameter hole need be made.

There are two types of Rawlbolts—(a) Bolt Projecting type where the fixture is held by a nut tightening up on to a fixed bolt and (b) Loose Bolt type in which the fixture is held by a standard bolt screwed into an expansion member. Both types are available in sizes from $\frac{1}{4}''$ to $\frac{3}{4}''$ diameter. Full technical details together with prices will be sent free, on application to address shown below.

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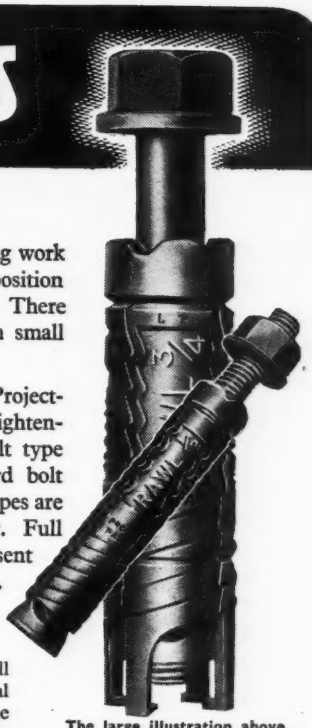
There is a Rawlplug tool for boring holes of all sizes in all materials. They are made of a special steel manufactured to our own analysis. The range includes Rawldrills, Tile Drills, Tubular Drills, Star Drills, Caulking tools, etc. May we send you fully illustrated literature of the complete range ?



The large illustration above shows the Loose Bolt type Rawlbolt and the smaller illustration shows the Bolt Projecting type.

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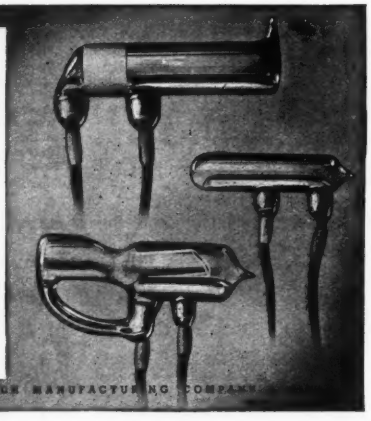

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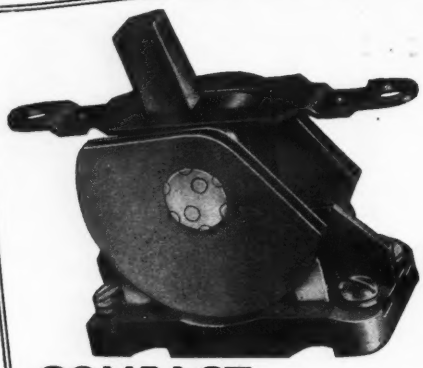

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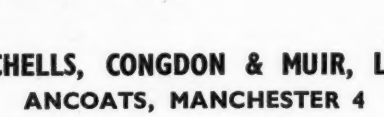

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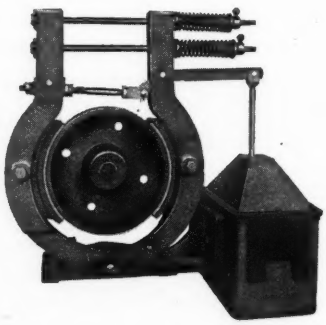

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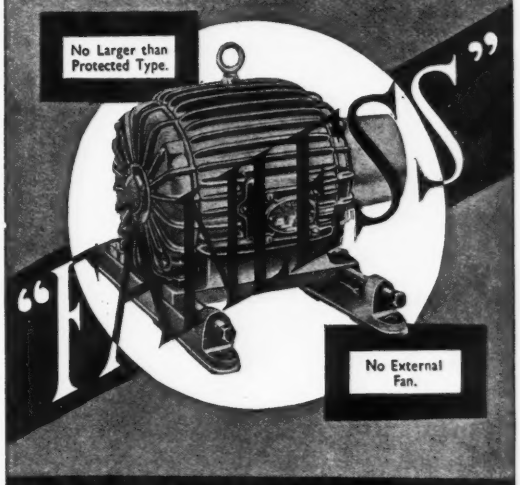

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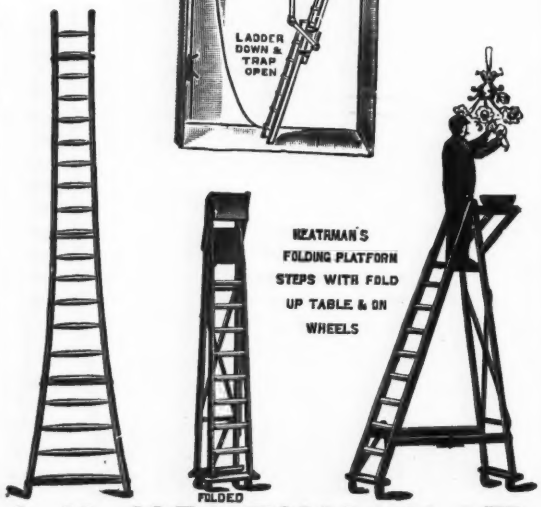

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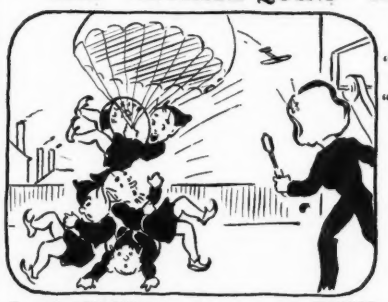

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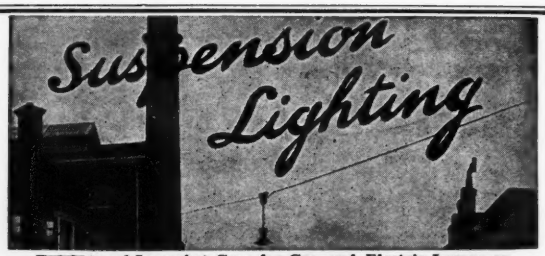

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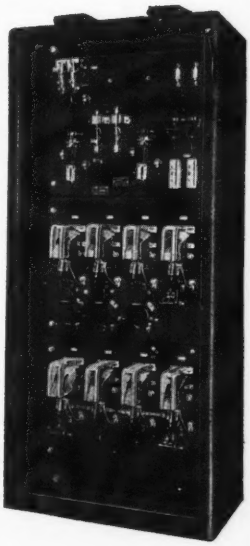

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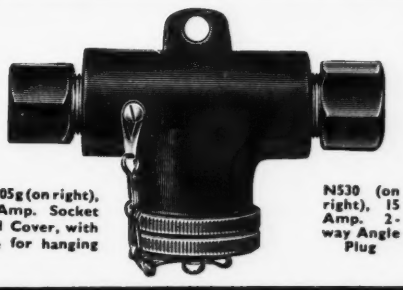

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